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THE TREATMENT OF ACUTE OTITIC MENINGITIS.

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Of the various complications of purulent otitis media, otitic meningitis has been the one condition most difficult of diagnosis and least amenable to surgical treatment. The symptoms of the disease are often obscure, and no definite plan of surgical procedure has yet been outlined which will enable the surgeon to bring the case to a favorable termination. Owing to the magnitude of the subject under discussion, our distinguished colleague, Dr. Lermoyez, has consented to consider simply the diagnosis and symptomatalogy of otitic meningitis, and has courteously left to me the task of speaking to you on the subject of the treatment of this important condition.

The treatment of an otitic meningitis depends very largely upon the character, location, and extent of the meningeal inflammation. For this purpose, therefore, I will divide our cases into certain groups: (1) Those cases involving a limited area of dura alone, that is, cases of extradural or epidural abscess. (2) Those cases in which a general meningitis is present. These cases may be divided into (*a*) a serous meningitis involving principally the subdural space, and (*b*) a serous meningitis involving both the subdural space and the lateral ventricles. (3) Cases of purulent meningitis, involving the subdural space over a localized area. (4)

[1] Read at the Eighth International Otological Congress, held at Budapest, August 29 to September 4, 1909.

Cases of general purulent meningitis, involving both the subdural space and the lateral ventricles.

With the assistance of one of my confrères, Dr. Charles E. Perkins, I have collected from literature 101 cases of otitic meningitis of various forms. Of these cases, 45 were cured and 56 died. Of the cured cases, 34 were cases of serous meningitis, 4 were cases of circumscribed purulent meningitis with serous meningitis, and 4 were cases of circumscribed purulent meningitis; diffuse purulent meningitis occurred in 3 cases. Of this series of cases, the operative procedures instituted for their relief were sufficiently interesting to be reported somewhat in detail, in that they afford us certain data for formulating the treatment in similar conditions.

It is worthy of note that in 6 of the cases all that was necessary to relieve the meningeal symptoms was first to clear out the local focus of infection by means of either the simple mastoid operation or the complete radical operation, and second, to relieve, temporarily, the increased intracranial pressure by lumbar puncture. In most instances, however, the operative treatment was more complex, and consisted, first, in thoroughly clearing out the site of infection, either by means of the radical operation or the simple mastoid operation, as circumstances might demand; that is, the radical operation was performed when the condition followed a chronic purulent inflammation, while in those cases following an acute otitis media the simple mastoid operation was all that was necessary. In addition to the treatment directed to the site of primary infection, in 9 cases an epidural abscess was evacuated. In 4 cases simple exposure of the dura, with lumbar puncture, relieved all the meningeal symptoms. Drainage of the lateral ventricle was performed 7 times, and in one of these cases the fluid evacuated from the ventricle was purulent. In 18 cases the dura was incised, and in 5 of these the dural incision evacuated a purulent fluid. In 3 cases the meningeal symptoms followed a sinus thrombosis, and the jugular was excised for the relief of this condition. It is especially noteworthy, in reviewing this series of cases, to remark that in 20 cases out of 45, lumbar puncture was performed, and that this procedure seemed in no small way to contribute to the successful result of the other operative measures.

Going over my own statistics of meningitis, I find that I have operated on 65 cases of otitic meningitis, of all varieties. In 54 of these cases the meningitis was of the most simple variety, that is, a circumscribed purulent pachymeningitis, and of these 54 cases, 48 recovered and 6 died. Death was due in 1 case to septic pneumonia, in 1 case to diabetes, 1 case died of cerebellar abscess, and 3 cases died of general meningitis. These personal statistics show, therefore, that a localized meningitis, promptly treated, is a complication of no special gravity—that there is little ten-

dency for it to extend to the general meninges, and that if properly treated, the case will almost invariably terminate favorably. Eleven of the cases operated upon were cases of general meningitis. Of these, 3 recovered and 8 died. The cases which recovered were all of the serous variety.

I will now consider the various operative procedures which were instituted in these cases for the relief of the condition. In cases in which a simple localized meningitis is present, and in which this inflammatory process involves simply the dura, all that is necessary is first to clear out the local site of infection, either by the complete mastoid operation, in cases following an acute otitis media, or the radical operation in cases following a chronic purulent middle-ear inflammation. This operative procedure must be complete, if beginning meningeal symptoms are to be controlled. Every vestige of diseased bone must be removed. When, during the operation, a collection of pus is found between the dura and the bone, it is necessary to remove completely the bone overlying the infected dura. It is important, however, that the removal of the bone should not extend beyond the limits of the extradural abscess. The extent of the dural inflammation is usually well defined by adhesions which develop between the dura and the bone, about the margins of the abscess. The bone should be removed to the very edge of these dural adhesions, but not beyond this point. The surface of the dura is usually covered with granulation tissue, this granulation tissue varying in thickness according to the duration of the inflammatory process. It has been my practice to curette this granulating dural surface very gently, so as to remove all necrotic tissue, while, at the same time, the healthy granulation tissue is disturbed as little as possible. Care must be taken not to use the curette too forcibly, as frequently the subdural space is separated from the abscess cavity by an extremely thin layer of dura, and too vigorous use of the curette might open the subdural space and lead to a fatal leptomeningitis. Necrotic granulations, therefore, should be removed carefully, while healthy granulations should be left. After the entire abscess cavity has been thoroughly exposed, it should be packed with iodoform gauze. The subsequent management of the case requires no special description.

In cases in which the meningeal inflammation involves either the subdural space, the lateral ventricles, or both, the operative procedures must vary according to the extent of the meningitis and its character, that is, as to whether the meningitis is confined chiefly to the subdural space or whether it involves the ventricles as well, and secondly, as to whether it is of the serous or purulent variety.

In the 11 cases of general meningitis upon which I have operated, as before stated, 3 terminated favorably. The procedure in one of these cases consisted simply in draining the extradural space and making a free incision in the dura over the involved

area, thus relieving pressure in the subdural space. In a second of these cases the complete radical operation, with free opening of the superior and external semicircular canals, was followed by a cure. In the third case, complicated by a temporosphenoidal abscess, symptoms of serous meningitis came on after the evacuation of the abscess. In this case, incision of the dura, lumbar puncture, and drainage of the ventricle were followed by complete recovery.

From my own series of cases, together with those which I have collated from literature, it seems that we may be in a position to formulate somewhat exactly the treatment of this condition, which has, up to the present time, caused so much trepidation among otologists. First and foremost, should be placed the prophylactic measures. Every acute middle-ear inflammation should be treated along modern surgical lines—by early and free incision of the drum membrane, thus affording a prompt evacuation of the products of inflammation in the tympanic cavity, and lessening the possibility of extension of the inflammatory process inward to the cranial cavity.

Secondly, when the inflammation has extended to the cranial cavity, producing symptoms of meningitis, the first indication is thoroughly to eradicate the primary focus of infection by performing either the complete mastoid or the complete radical operation, as the case may be. It has been conclusively proved by postmortem examination that the most common site of extension of an inflammatory process from the middle ear to the meninges, is through the labyrinth: consequently, whenever meningeal symptoms appear, a careful examination should be made to discover any fistulous tract in the external labyrinthine wall. These fistulæ are most common in the horizontal semicircular canal, although infection may take place through the superior or the posterior semicircular canals or through the oval window. In cases in which the labyrinth is involved, thorough drainage of the labyrinth is imperatively indicated. This is best secured by enlarging any fistulous tract which may be found in the semicircular canals, the tract being enlarged toward the vestibule, so as to secure complete drainage. If the infection has occurred through the oval window, the vestibule should be drained in this region by enlarging the oval window downward and forward, so as very thoroughly to drain the cochlea. After cochlear drainage is instituted, the vestibule should also be drained behind and above the facial ridge by opening the external semicircular canal. In one of my own cases drainage of the vestibule through the horizontal and superior semicircular canals was all that was required.

If the meningeal symptoms are pronounced, and indicative of increased intracranial pressure, lumbar puncture should be performed at the same time that the middle-ear cavity is exenterated.

Many have questioned the value of lumbar puncture as a therapeutic measure. In one of my own cases, and in two reported by my

distinguished colleague, Dr. Lermoyez, at the last International Otological Congress, this measure certainly was of distinct therapeutic value. I believe that, in all cases in which meningeal symptoms are pronounced, lumbar puncture should be performed, not only as a diagnostic measure, but as a means of relieving temporarily, at least, the intracranial pressure. From 20 to 40 c.c. of cerebrospinal fluid may be withdrawn, the amount of fluid taken away depending very largely upon the degree of intradural pressure. Care must be taken not to withdraw the fluid too rapidly, as too sudden relief of pressure may be followed by a hemorrhage into the brain substance. In some cases repeated lumbar puncture must be performed, the operation being repeated whenever there is evidence of increased intracranial pressure, as indicated by a low pulse rate, beginning choked disk, stiffness of the neck, or other similar symptoms.

In cases in which the meningeal symptoms are exceedingly pronounced, more radical measures may be demanded at the time of the first operation. In other words, the invasion of the meninges may have been so rapid that the removal of the primary focus of infection and the reduction of intracranial pressure by lumbar puncture may not be sufficient. We must also remember that in a certain number of cases of sudden increase in intracranial pressure, the foramina of Monro and the foramen between the third and fourth ventricles, may be blocked, thus preventing the escape of ventricular fluid into the spinal canal. In such cases lumbar puncture would not relieve the symptoms. In cases, therefore, in which the meningeal symptoms are extremely urgent, it is wise at the time of the primary operation to relieve the intracranial pressure by means of a decompression operation. This operation would naturally be indicated on logical grounds, and its efficiency is borne out by the statistics which I have collated. In 18 of the 45 cures already mentioned the dura was incised. Incision of the dura, therefore, should be performed in all cases in which meningeal symptoms are pronounced.

My own practice, in cases of this character, is as follows: The squama is exposed by an incision extending from the upper extremity of the ordinary incision made for exposing the mastoid, upward, and then forward and downward to a point just behind the external angular process of the frontal bone. This incision extends through the integument, the temporal fascia, and the temporal muscle. The musculocutaneous flap is then pushed downward and the middle cranial fossa entered just above the zygoma by means of a gouge. The opening in the cranial cavity is rapidly enlarged by means of the rongeur forceps, forward, upward, and backward, so as to expose the temporosphenoidal lobe over an area of, at least, three inches in longitudinal measurement and two inches in vertical measurement. The base of the temporosphenoidal lobe should

also be exposed by extending the opening in the squama downward and backward, so as to remove the roof of the middle ear and the roof of the mastoid antrum. The dura is next incised. It is a matter of preference as to whether the dura is incised vertically or longitudinally. Personally, I prefer to open the dura by two crossed incisions of about one and one-half inches in length. These incisions serve two purposes: first, they thoroughly drain the subdural space, and second, if there is a collection of fluid, either serous or purulent within the lateral ventricles, they allow the brain substance to expand outward, thus relieving the intracranial pressure. The operation is exactly analogous to the one performed in cases of inoperable tumors of the brain. It is my practice to pack about the margin of this incision with iodoform gauze, so as to secure drainage of the subdural space, and at the same time to cause a certain amount of amalgamation between the two layers of the pia, in case the subdural collection of fluid is small and the intraventricular collection large. I do not think it wise, as a rule, to open the lateral ventricle at the time of the decompression operation. The relief of intracranial pressure which follows incision of the dura will ordinarily be sufficient to relieve the urgent symptoms, and the ventricle can then be opened subsequently.

While decompression over the temporosphenoidal lobe is of undoubted value in certain cases, it may also be necessary to perform a similar operation over the cerebellum. This is best performed by making a horizontal incision from the superior extremity of the mastoid incision, directly backward to the median line. The incision may then be carried downward for an inch or an inch and a half, dividing all the soft tissues down to the bone. In this way a musculocutaneous flap can be reflected downward, exposing the cranium over the region of the cerebellum. As in operations of this character the operator would have already exposed the dura covering the lateral sinus, it is only necessary to enlarge the opening in the bone backward and downward by means of the rongeur, to the median line, in order to expose the cerebellar dura over a large area. Two incisions, crossing each other at right angles, should then be made through the cerebellar dura, exactly as described in considering the decompression operation over the temporosphenoidal lobe. Incisions through the dura, for the relief of intracranial pressure, have been of unquestionable value.

Regarding the value of drainage of the lateral ventricles, these were drained seven times in the forty-five cases which were cured, and in one instance the lateral ventricles contained pus. I have performed drainage of the lateral ventricle in three cases, with one recovery, and drainage of the fourth ventricle in two cases, both of which terminated fatally. It is interesting to note that in one case, in which the fourth ventricle was drained, the patient lived ten days after the operation, and finally died of a hemor-

rhage into the spinal canal. So that drainage of the fourth ventricle, through the cerebellar substance, is a procedure which may possibly be of value in these cases.

In establishing ventricular drainage, the best procedure, according to my opinion, after incising the brain substance and entering the ventricle, is to pass two very thin-bladed retractors into the ventricle, and, by separating these retractors slightly, gradually to evacuate the ventricular fluid. A folded rubber-tissue drain can then be inserted between the retractors, the retractors removed, and the drain left in position. This effects a slow and regular drainage of the ventricle, and is, I think, preferable to the use of either a gauze drain or a drainage tube.

Regarding the technique of the decompression operation, some operators, notably Cushing, of Baltimore, prefer to do what is termed an "intermuscular" operation. The incision through the integument is made in exactly the same manner as the one previously described. This incision, however, extends only through the integument. The margins of the incision are elevated by dissection. The temporal fascia is next incised in the same way, and this, together with the integument, is reflected from the underlying temporal muscle. The fibers of the temporal muscle are then separated longitudinally, so as to expose the squama. The periosteum is now divided, the middle cranial fossa entered through the squama, and the opening enlarged beneath the temporal muscle. The advantage of this procedure lies in the fact that the temporal muscle is not divided, and consequently, there is less danger of hernia cerebri.

As, in cases of otitic meningitis, we are dealing with an acute process, the necessity of doing an intermuscular operation for the relief of pressure is much less than in cases of increased intracranial pressure due to brain tumor.

I believe, in the cases now under consideration, that the operation as described by myself is rather better than the intermuscular method, as it can be performed much more rapidly. In the same manner, the decompression operation over the cerebellum may be performed by the intermuscular method, the first incision dividing simply the skin and superficial fascia. The muscular fibers covering the skull over the cerebellum may then be separated and the overlying bone removed, in the manner already described. In this region, also, I believe that the intermuscular operation possesses no advantages.

As we know, both from clinical experience and postmortem examination, that one of the most frequent avenues through which the meninges become invaded is the labyrinth, and as the subdural space communicates with the labyrinth through the aqueductus vestibuli and aqueductus cochleæ, it has seemed to me that, in certain cases of otitic meningitis which come on suddenly, good

results might be obtained by opening the cranial cavity in the region where the aqueductus vestibuli and aqueductus cochleæ open into the subdural space. These canals open into the subdural space on the posterior surface of the petrous pyramid, the aqueductus vestibuli entering the subdural space just in front of the lateral sinus and behind the internal auditory meatus on the posterior surface of the petrous pyramid, while the aqueductus cochleæ opens into the subdural space on the lower margin of the posterior surface of the petrous pyramid, just below the internal auditory meatus. The subdural space, therefore, could be opened in this region by incising the dura in front of the lateral sinus. Where the sinus is far forward, it is difficult to gain space enough to do this without risk of injury to the facial nerve. In the majority of cases, however, there is space enough in front of the lateral sinus to make a vertical incision three-quarters of an inch in length, through the dura, while a horizontal incision three-eighths of an inch in length could be made in most cases. Access could thus be gained to the posterior surface of the petrous pyramid and the subdural space drained at the very site of infection.

In cases, therefore, in which the meninges have been infected through the labyrinth, it may be found wise to drain the subdural space in this region, rather than posterior to the lateral sinus. I certainly think that in some of the cases in which otitic meningitis develops very rapidly, drainage of the subdural space in this region is, at least, worthy of a trial.

I may sum up, then, the surgical treatment of the disease under consideration, as follows:

1. The surgeon should always remove the primary focus of infection, either by the complete mastoid operation or the complete radical operation, according as the disease is dependent upon an acute or chronic middle-ear suppuration. At this time, any extradural collection of pus should be thoroughly evacuated.

2. Any fistulous openings in the outer wall of the labyrinth should be enlarged and the labyrinth drained by opening the semicircular canal, vestibule, and cochlea.

3. With symptoms of moderate intracranial pressure, lumbar puncture should be performed to relieve this pressure.

4. With symptoms of severe intracranial pressure, or in cases of moderate intracranial pressure, when lumbar puncture is negative, a decompression operation should be done, either over the temporosphenoidal lobe or over the cerebellum, or in both situations.

5. If the symptoms are extremely urgent, the lateral ventricle may be opened at the time of the decompression operation. Preferably, however, the opening of the ventricles should be delayed for from twelve to twenty-four hours, in the hope that incision

of the dura may relieve the tension temporarily, and that the effused fluid may be absorbed.

6. In cases in which the infection seems to have travelled through the labyrinth to the subdural space, drainage of the subdural space on the posterior surface of the petrous pyramid, in the region of the aqueductus vestibuli and aqueductus cochleæ, should be instituted.

These comprise our various measures for the surgical treatment of acute otitic meningitis. Whether, at some later day, serum therapy may come to our aid in the treatment of otitic meningitis is, of course, open to question. The brilliant results which have been already attained in cases of epidemic cerebrospinal meningitis, by the use of the antimeningococcic serum, may lead us to believe that at some future date an injection into the spinal canal of a serum antagonistic to the particular germ causing the meningitis might be of value. A few cases have been treated with antistreptococcic serum. The results, however, are too uncertain and the number of cases too small to allow any definite opinion to be given on this subject at present.

SOME POINTS IN THE TREATMENT OF CHOREA IN CHILDREN.

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Chorea is a common disease of childhood, and in certain districts it is very prevalent. We see it in many phases—from the very acute maniacal form to the mild or chronic varieties, which may last for months. The treatment of chorea, while generally satisfactory, is sometimes a matter of difficulty, and the disease may effectually baffle the resources of the practitioner. When we consider that in many instances chorea is a rheumatic manifestation(and there is considerable proof that it is entirely so), that the child suffering from this disease may be subjected to much teasing, and may be punished unjustly, it is evident how important it is that prompt and appropriate treatment should be enforced.

Rest. The first point in the treatment of patients suffering from chorea is rest, and without rest any other treatment will be futile. This applies to all cases, whether they be of the acute or chronic types. For a child this means treatment in bed, because in no other way can rest be insured. If the child is allowed to go about, little or no amelioration will take place, and the disease will drag on for months. No more striking testimony can be brought forward in favor of rest than the fact that a child with chorea may attend the out-patient department of a hospital for months without benefit, but,

if admitted to the hospital and treated in bed, in the course of ten days or a fortnight the condition will be relieved, and afterward, by the judicious control of the child's life, a permanent cure may be effected. It is practically useless to advise the mother of a hospital out-patient to give the child rest. The instructions are generally neglected, and the child is allowed to romp and play with his companions. The consequence is that the child may become excited, and this cannot fail to exercise a deleterious effect on the condition. In private practice the want of efficient rest will often delay convalescence for many weeks, although in other respects the circumstances are more favorable. It is extremely difficult to persuade the parents of a child who has chorea of a very mild type that rest in bed is essential, but it is only thus that a rapid cure can be effected. The quieting effect of rest in bed does much to allay the muscular irritability, and the freedom from excitement, which can best be insured by this means, helps to allay also the mental instability. There is only one circumstance which contra-indicates rest in bed. It sometimes happens that if a child with mild chorea be put to bed, he becomes very depressed, and this is bound to influence adversely the condition. In such cases, which are fortunately rare, forcible detention in bed will do more harm than good, and, therefore, one must needs be content with modified rest. The child with mild chorea does not feel ill, and so detention in bed suggests to his mind something of the nature of punishment. In such a case the child may be kept in bed for an hour or so each day, perhaps until noon, and then be allowed to get up and rest on a couch. The length of time a child must be kept in bed, of course, varies, and each case requires individual consideration and must be judged on its merits. In some very mild cases it may not be necessary to keep the child in bed for more than a few days, but afterward the child must rest on the couch for several hours each day, and violent exercise or excitement must be prohibited. Few cases require treatment in bed for longer than five or six weeks, and for an average case in which the symptoms are marked, but not acute, three weeks or a month will generally suffice. In all cases after the child gets up he must take things very easily, and no exertion, either physical or mental, should be permitted for some weeks. To allow a child who has been for a time in bed to indulge almost immediately in cycling, football, rowing, etc., will undo all the good work, and will very likely lead to a relapse. One has only to remember that chorea is most probably a complication or manifestation of rheumatism to understand why rest should be so persistently indicated. In chorea there is the possibility of cardiac involvement, and the severity of the attack is no criterion of the damage that may be done to the heart. Indeed, it is very often in the mild cases that most damage to the heart occurs. This fact is a very strong point in favor of the treatment of mild chorea by rest in bed, and afterward for enforcing the gradual return to healthy and vigor-

ous exercise. It is, however, unwise to keep the child too long in bed, and he should be permitted to get up at the earliest possible moment consistent with safety. Much harm is done by keeping the child in bed for weeks, and it would be better policy to treat him by modified rest on a couch, after say six weeks, although the choreic movements have not completely ceased.

ISOLATION. In cases of an acute or semi-acute nature, isolation is often required. In a hospital this may be conveniently carried out by having screens placed around the cot, or the case may be treated in a side ward. In the acute cases the child's limbs, especially at the knees and elbows, should be enveloped in cotton wool; the sides of the cot should be padded, and the mattress must be a soft one, or a water bed may be used, so that the patient may do himself no injury when tossing to and fro. In some cases a special nurse to attend to the patient is a matter of necessity. The child should certainly not be tied down in bed, a practice recommended by some. Such can only be described as heartless cruelty, and there is good reason to believe that choreic movements should be quite unrestrained. Any necessary restraint can be applied by the nurse, and a capable nurse can easily effect this purpose without the child being aware that he is being restrained. In private practice the question of isolation is a matter of much difficulty. The parents are, naturally, averse to the child being isolated, but they will generally consent if the matter be put before them in a proper manner. If the mother is a sensible woman, the child can be left in her charge, but the other members of the household should be excluded, or the child's nurse, if a capable person, may take him in hand. To leave a highly strung, nervous, and excitable child in the charge of a neurotic mother or nurse is useless, and the results of treatment will be disappointing. It requires a person of firmness and tact to undertake the successful charge of a choreic patient. While anything likely to irritate the child should be avoided, it is not advisable to pander to all his whims and caprices. If the mother or other members of the household are incapable (from a medical point of view) of looking after the child, then a trained nurse who is in sympathy with children should be engaged. It is often advisable to send the child away for treatment with a friend, or nurse, who is well known, and will be a congenial companion to him.

Bruel[1] divides the rest and isolation treatment into four degrees of completeness, according to the severity of the case: (1) Going to bed early and rising late, so as to spend fourteen hours in bed; (2) going to bed also for two hours in the middle of the day; (3) absolute rest in bed for a fortnight, with very little visiting by relatives; and (4) darkening of the room, except at meal times. Except in bad cases it is not necessary to enforce strict isolation. In the milder cases, if it should be thought necessary that other members of the

[1] Rev. mens. des mal. de l'enf., June, 1906.

household should not see the child, it is much better to advise the sending of the child to the country, or to the seaside, along with some relative or friend.

DIETING. This is considered by many physicians to be an important desideratum in the treatment, and some enthusiasts have drawn up special dietaries. Dr. Goodhart believes in a special dietetic régime for these cases. He[2] recommends the following diet for chronic cases treated by massage, etc., and he says that in his hands it has proved of benefit.

"At 5.30 A.M., half a pint of warm milk and three slices of bread and butter (each slice an ounce in weight); 9.45 A.M., one-half ounce Kepler's malt extract in lemonade; 10 A.M., massage (fifteen minutes), followed by one-half pint of warm milk; 12.30 P.M., rice pudding, one-half pint of milk, green food, and potatoes; 4.15 P.M., one-half pint of warm milk, three slices of bread and butter, and an egg lightly boiled; 7 P.M., one-half ounce of Kepler's malt extract in lemonade; 7 or 8 P.M., massage, followed by one-half pint of milk. At the end of ten days or a fortnight the bread and butter is increased to four slices, a lean chop is added to the mid-day meal and an extra pint of milk is distributed over the twenty-four hours." For my part, with the exception of the acute cases, I make little alteration in the diet. In the acute cases I give a fluid diet consisting of milk, egg flip, beef tea, etc., but in the mild chronic cases I give an ordinary diet suitable to the age of the child, with an extra quantity of milk. The diet should be nutritious and easily digested, and will consist chiefly of bread, with butter or dripping, eggs, fish, chicken, rabbit, minced meat, milk, green vegetables, potatoes, and plain milk puddings. Sugar and starchy foods should be reduced to a minimum; indeed, it is well to forbid all sweet things. Tea, coffee, and alcohol should be avoided. It is important that considerable quantities of milk should be taken, but it unfortunately sometimes happens that the child will not tolerate large quantities, or may even refuse to take any milk. The milk may be modified in various ways, and may then be more acceptable to the patient. The milk may be diluted, either with ordinary water, lime water, or soda water. Mixing the milk with mucilaginous fluids, such as barley water, or thickening the milk with a little corn flour or gruel will render it more digestible. Perhaps the child will take the milk when peptonized, or will tolerate it when predigested, that is to say, in the form of "junket" or "curds and whey." Koumiss may be preferred by some. In the acute cases when the patient is on strictly fluid diet, it is a great loss if he cannot take milk or modified milk. There is nothing that equals milk as a nutrient fluid. It should be mentioned that in the very acute forms of the disease it may be necessary to administer nourishment in the form of nutrient enemata.

[2] Goodhart and Still's Diseases of Children, p 807.

THE BOWELS. The bowels must be attended to, and every endeavor should be made to insure their regular action. An aperient is given occasionally if necessary. Some give a small dose of calomel now and again, but the actual aperient is not important, provided the bowels act regularly.

EXTERNAL APPLICATIONS. Many external applications have been recommended at one time or another, but some are worthless. The hot pack is employed by some practitioners, and certainly this undoubtedly exercises a beneficial effect in many instances and its application is often followed by sound and refreshing sleep. It is a form of treatment which has a peculiarly soothing effect on the patient, and more than anything else earns his gratitude. If the movements are not too violent a warm bath at night has a distinctly calming effect, and may overcome insomnia. In cases in which there is hyperpyrexia cold packs should be used, and during convalescence or in the mild forms cold or tepid sprays should be employed. The cold spray is invaluable: for the first few times it may be well to employ tepid water, but cold water should be used as soon as possible and will be found most invigorating. It is well to remember that the cold spray should only be continued if a healthy reaction follows its application, that is to say, when the patient is afterward rubbed with a towel there should be a warm glow of the skin, and he should feel warm, not cold. The application of blisters to the spine, the use of the ether spray to the spine, and the freezing of the spine with ethyl chloride are unnecessary and useless. Massage is of great value and should be carried out night and morning after the acuter symptoms have subsided. It is especially useful in cases in which there is any muscular wasting or any tendency to paralysis. This massage should be practised for ten to fifteen minutes, night and morning, and should only be carried out under skilled supervision. The massage is at first gentle rubbing, and is then succeeded by kneading of the muscles. The exponents of electrical treatment have not only failed to demonstrate its superiority over massage, but have also failed to prove its value.

DRUGS. The drugs that have been recommended for chorea are legion. That internal medication often renders important services can scarcely be denied, and the benefits derived are chiefly in the chronic cases. It is doubtless true that many cases would recover with simply rest, good food, and nursing, but I feel sure that the cure is hastened and convalescence shortened by certain drugs. Among the drugs that have been tried are: Zinc sulphate, arsenic, sodium salicylate, potassium bromide, ammonium bromide, veratrum viride, acetyl-salicylic acid, antipyrin, exalgine, trional, bromural, chloretone, strychnine (Trousseau), conium (Harley), ergot (Eustace Smith), etc. I have had experience with six of these drugs, namely, antipyrin, potassium bromide, sodium salicylate, chloretone, arsenic, and acetyl-salicylic acid. The first three I have found of

little use, and I have never been able to satisfy myself that they exercised any beneficial effect on the morbid process. Antipyrin and potassium bromide have never received much support except for their sedative properties, but salicylate of sodium has many advocates, among whom none is more enthusiastic than Dr. D. B. Lees, of London. He advises[3] enormous doses of the salicylate of sodium, 200 grains or more per diem, and he prescribes along with it large doses of bicarbonate of sodum. He is emphatic in his assertion of good results, and other observers have also spoken favorably of it. In my hands the drug has been an absolute failure, and other physicians have also had this experience. I do not give anything like the large doses recommended by Lees, as I consider the exhibition of these enormous quantities of this drug a very risky procedure. Chloretone I have used in only two cases (mild), and although recovery followed, it is doubtful whether the credit should be given to the drug. Wynter,[4] however, speaks of its value in several cases, but Ranking[5] records a case in which it was apparently worthless. Voelckner supports Wynter[6] in testifying to the value of this drug. He says: "The period of attack, the severity of the movements, and the mental instability were all favorably influenced by the drug, but it has some minor disadvantages, in this, that it is rather apt to make the children too drowsy, and there is sometimes produced an erythematous rash and the eyes get a puffy appearance not unlike that produced by whooping cough, but unaccompanied by albuminuria." With arsenic and acetyl-salicylic acid I have had good results, and the improvement was so marked after the exhibition of these drugs as to justify the conclusion that they played a part in the cure. With regard to arsenic, this was for many years the sheet anchor in the treatment of chorea, and certainly good results followed its use in a number of cases. Of late there has been a reaction against its employment, and this reaction is probably directly due to the haphazard method in which it was being prescribed. It was given by many simply because it had a reputation of being the drug to cure chorea, and no scientific reason was forthcoming. One great objection to it is that the condition is liable to recur as soon as it is discontinued. As regards the mode of administration, it is generally given as Fowler's solution, and the dose is small to begin with, and is increased gradually until large doses are being taken. My practice was to prescribe 3 to 5 minims of liquor arsenicalis three times a day, and increase the dose by 2 minims every second day until the child was taking 16 to 20 minims of the liquor Fowleri thrice daily. By the time this dosage had been reached the movements had ceased, and then the doses were gradually decreased in the same ratio as they had

[3] The Treatment of some Acute Visceral Inflammations, and other papers, London, 1904.
[4] Lancet, London, March 30, 1907.
[5] The Hospital, January 11, 1908.
[6] Folia Ther., April, 1908.

been increased; and the child continued to take 5 minims of liquor arsenicalis thrice daily for some weeks. By this means many cases recovered. Small doses of arsenic are useless, and the opinion of most of those who have used arsenic successfully is that large doses, which are worked up to gradually, are necessary. The arsenic should not be abruptly stopped. It is true that occasionally symptoms of poisoning supervene. I have had one such case in which a little girl, aged seven years, when taking 12 minims of the liquor arsenicalis, developed toxic symptoms, indicated by peripheral neuritis and a punctate erythematous rash. On withholding the drug for forty-eight hours the symptoms disappeared, and the drug was then continued, but in more moderate doses. Gordon Sharp[7] believes in saturating the tissues rapidly with arsenic. For a child between eight and fifteen years of age he orders:

℞—Liq. arsenicalis.	. . . . .	℥ss
Tinct. capsici	. . . . .	♏xxv
Ext. glycyrrhizæ liq.	. . . . .	℥ss
Aq. chloroformi	. . . . .	℥vj
Aquæ	. . . . . ad	℥xij

M. Sig.—One tablespoonful three times a day immediately after meals.

That means that the child at once takes 10 minims of Fowler's solution in each dose, and this is 2 minims more than the maximum dose of the British Pharmacopœia. If after a week no improvement is manifest, he increases the amount of the liquor arsenicalis in the mixture to 300 minims. He believes that if arsenic is going to do good in chorea, it will show its beneficial action within the first fortnight. When progress is being made he continues this treatment until the patient can walk along a straight line, or stand on the leg of the affected side with steadiness. After all the movements have ceased he prescribes the following:

℞—Sodii bicarb.	. . . . .	℥ij
Tinct. capsici	. . . . .	♏xxv
Ext. glycyrrhizæ liq.	. . . . .	℥j
Aq. chloroformi	. . . . .	℥vj
Aquæ	. . . . . ad	℥xij

M. Sig.—One tablespoonful three times a day after meals.

According to him this latter mixture is given because it "washes the arsenic out of the tissues;" but he admits that the statement may not be scientific.

Objection has been taken to arsenic in certain quarters. Burnet,[8] in discussing the treatment, vigorously attacks arsenic as a remedy for this disease. He sums up his objections to it as follows: (1) Large doses have to be given, and these may induce neuritis; (2) the results achieved are rarely permanent; (3) arsenic exercises no

[7] Practitioner, February, 1908.

[8] British Journal of Child. Dis., October, 1908.

influence over the complications and sequels of chorea; and (4) it does not benefit in any way the rheumatic constitution of the patient. He believes that the cure by arsenic is brought about by poisoning and probably paralyzing the nervous system. Koplik[9] attacks arsenic on the ground that it is dangerous because of its effects on the kidneys. When arsenic is given by the intensification method, albumin may appear in the urine before any other toxic symptoms, sometimes when only fifteen drops of the liquor are being given daily to a child aged six or eight years; this clears up when the treatment is suspended. Casts may also appear, and even blood cells. Koplik states that the urine is the best test for the limit of toleration of arsenic. I have never found albuminuria after the administration of large doses of arsenic in any of my cases, not even in the one in which toxic symptoms resulted. Still it is a danger that must be kept in mind. Though arsenic will bring about recovery in many instances, it must be admitted that Burnet's contentions are most reasonable, and one is, therefore, inclined to discontinue this drug as an active agent in the treatment of chorea if a better drug can be found.

During the last three or four years I have relied on acetyl-salicylic acid, and I have come to regard it as the drug *par excellence* for the treatment of chorea. I have placed on record some of my cases[10] which were treated with this drug, and since then I have used the drug in practically all my cases, and up to the present it has not failed to effect a cure. Wall[11] speaks highly of the drug, and Burnet[12] has had very favorable results in his practice. This drug was originally introduced as an antirheumatic remedy, but its usefulness is not limited to those cases of chorea in which there is a history of rheumatism. It does well in all cases, whether acute, subacute, or chronic. After salicylate of sodium has failed to effect a cure, acetyl-salicylic acid may prove of benefit, as is indicated by the following case:

I. R., a girl, aged eight years, came under observation in March, 1907, for chorea. It was her first attack, and characteristic choreiform movements of fairly acute nature were manifest. There was a strong rheumatic history. She was put on sodium salicylate (20 grains every six hours), but after three weeks of this treatment no appreciable benefit had resulted. Acetyl-salicylic acid (10 grains every four hours) was then substituted; immediately a change for the better was noted, and in a fortnight the patient was cured of her attack. In this case the salicylate was given a fair trial, but apparently exercised no curative effect on the disease. One would have thought that in a case in which there had been rheu-

[9] Medical Record, January 18, 1908.
[10] The Hospital, July 27, 1907.
[11] Therapeutical Society's Transactions, 1907; also Medical Press, May 20, 1908.
[12] Loc cit.

matism the salicylate would have acted well, but it only confirms the observation of others, who have noted that chorea may develop in a patient suffering from rheumatic fever and under treatment with salicylates, which evidently therefore have no prophylactic effect on the condition. In non-rheumatic cases acetyl-salicylic acid doubtless acts in virtue of its analgesic and sedative properties; for children it is far superior to sodium salicylate, because its taste is not unpleasant and because ill effects are less likely to follow its use. The sweet, mawkish taste of sodium salicylate (and a more disgusting taste can hardly be imagined) cannot be covered, and in many cases the forcing of the child to take this drug would probably do more harm than good. Acetyl-salicylic acid may be given in powders, in cachets, or in a mixture. My experience is that the last is the best method for children, and the following prescription will be found useful:

℞—Acid. acetyl-salicylic		ʒiiss
Gum acac.		q. s.
Syr. aurantii		ʒj
Aq. chloroform	ad	ʒiv

M. Sig.—A dessertspoonful every four hours.

This is suitable for a child aged six years, The dose is increased to suit the age of the child, and for children at or about puberty 90 to 120 grains may be given in a day. It should never be given in tabloid form, and it should not be prescribed with alkalies. As regards unpleasant symptoms, these occasionally supervene after the exhibition of the drug, but far less frequently than with salicylate of sodium. In some cases gastric pain, vomiting, and giddiness follow. Tinnitus aurium is seldom met with. Painful œdema of the eyelid and lip has occasionally occurred. Epistaxis and erythematous eruptions are rare sequels. Lees[13] has recorded a case in which coma was produced. I have not had any such symptoms in cases of chorea in children in which this drug was used. The only symptoms that I have noted after the use of acetyl-salicylic acid (in conditions other than chorea) have been excessive perspiration in a few cases and tinnitus aurium in one case. It is not improbable that the bad effects may be attributed to faulty methods of prescribing or dispensing the drug. Gastric symptoms may be avoided if the precaution is taken of giving the drug only after meals and never on an empty stomach. The drug is not so likely to depress the heart as salicylate of sodium, although there are some who maintain that physiologically pure salicylate of sodium, if properly given, will not act as a cardiac depressant.

Since employing this drug in chorea I have never had to use hypnotics to induce sleep, even in acute cases. The following case, seen in March, 1908, may be quoted in illustration:

[13] Loc cit.

Annie G., aged sixteen years, came under treatment for acute chorea, the complaint having started three days before. No history of rheumatism. The movements were very violent, and she had to be constantly watched to prevent her doing injury to herself or throwing herself out of bed. She was quite unable to feed herself, and had no control over the sphincters. She was given fluid diet, and acetyl-salicylic acid (20 grains every four hours) was prescribed. During the first night she only slept for a couple of hours, but afterward she slept well. In a week's time all the movements had ceased, and after another week's rest in bed (with gradually decreasing doses of the acetyl-salicylic acid) she was able to get up and go about. It is doubtful whether simply rest in bed and dieting would have brought about this rapid cure. The behavior of this case would seem to lend support to the contentions of some German authorities, who maintain that acetyl-salicylic acid has an hyponotic as well as an analgesic effect. It should be noted that the drug should not be discontinued immediately on the cessation of the movements, but should be gradually stopped, and it is frequently advisable to continue giving it in small doses for many weeks. There need be no fear in advising the drug, because there is no tendency to sweating in a person going about if it be taken in moderate doses (5 grains twice or thrice daily). From the above facts it must be concluded that in acetyl-salicylic acid we have a most useful drug. Pleasant to take, comparatively free from unpleasant symptoms, and reliable in its results, the drug is one which should command attention and is well worthy of a premier place in the medical man's therapeutic armamentarium. The use of the drug is also based on scientific grounds, because it is antirheumatic and because its properties are analgesic and sedative, and, according to some, are also hypnotic.

With other drugs I shall only deal briefly. One or two have been so highly recommended by eminent physicians as to merit brief consideration. Of such drugs, trional may be mentioned. Voelcker believes that in trional we possess a drug which has a distinctly beneficial effect in chorea, both in alleviating the symptoms and in reducing the time required for the treatment of the disease. It does not cause cardiac depression, and the only unfavorable condition noted by him has been the very occasional occurrence of rather vivid dreams. He gives 5 grains three times a day as an initial dose to a child over four years, but the dose is gradually increased until the child is taking 5 grains every six or every four hours. He believes it is more advantageous to administer smaller doses at shorter intervals than to give larger doses at longer intervals. The following mode of exhibiting trional has been suggested:

℞—Trional . . . . . gr. xv
Pulv. sacc. alb. . . . . ʒij
Gum trag. . . . . gr. iij
Gum. arab. . . . . gr. iij
Aq. flor. aurant. . . . . ʒiiss
Aq. laur. ceras. . . . . ʒss
Misce et fiat emuls.
Sig.—One-third part to be taken in milk or water as a single dose.

Strychnine has found favor with some. Trousseau was a most enthusiastic advocate of strychnine, and Ewart[14] has recently written about it. It will probably be more especially useful in cases in which there is muscular wasting or in paralytic cases. The more hypnotic drugs, such as chloral, chloralamide, etc., are also used, but while it may be necessary to give such drugs occasionally in order to permit of the patient's getting sleep, it seems to me that they should not be used as part of the routine of treatment.

The fact that chorea may be a manifestation of rheumatism must be borne in mind, and the heart should be frequently examined to see that there is no cardiac involvement. It is probable that the value of strychnine rests in its acting as a cardiac tonic. In some instances there is serious damage to the heart, and it becomes imperative to deal efficiently with this. Strophanthus may be given, digitalis in my opinion not being a suitable drug for children. The following combination is a good one:

℞—Tinct. strophanth. . . . . ʒj
Liq. strych. hydrochlor. . . . . ʒss
Spt. aeth. . . . . ʒij
Syr. aurant. . . . . ʒj
Aq. chloroformi . . . . . ad ʒvj
M. Sig.—One tablespoonful three or four times daily for a child of five.

During convalescence tonic treatment is advantageous and is often required, because there may be considerable anemia. Iron in one of its various forms may be given, or iron may be combined with arsenic or cod-liver oil. A mixture of compound syrup of ferrous phosphate and cod-liver oil is well taken by children. My own experience recently is that small doses of arsenic form a valuable therapeutic agent for overcoming the condition of anemia. After the movements have ceased under treatment with acetyl-salicylic acid, and when this drug is being given in 5-grain doses two or three times a day, it has been my custom to prescribe 3 or 4 minims of the liquor arsenici hydrochloridi thrice daily, and, in several of my chronic cases with anemia, with very gratifying results. Any reflex irritation, as, for example, phimosis, carious teeth, worms, etc, while not, perhaps, an actual cause of chorea, will certainly aggravate the condition, and therefore they should be remedied.

[14] Trans. Soc., Study of Diseases of Children, 1906, vi, 192–95.

AFTER-CARE. A child has been treated and has recovered from the attack, but our efforts are not yet ended. Unless the child's life is carefully regulated, a relapse may take place. The child must on no account be permitted at once to indulge in physical or mental exertion. Quiet games which do not involve excitement may be allowed, but anything of the nature of racing should be prohibited. Return to school must not be thought of for two or three months, and then the lessons should be carefully regulated, and the child should not be driven to work. Some of these children are intellectually brilliant, and competitive examinations should be forbidden, or, at any rate, discouraged for such children. The excitement or strain of these examinations may be quite sufficient to determine an attack of chorea. On the slightest evidence of the return of the malady the child should be taken from school and sent into the country, away from its present surroundings. Inattention and fidgetiness are frequently seen in early cases, and a child is often unjustly punished on account of these symptoms. Again, the child may be afraid to sleep in the dark. In such circumstances the child may have a light in the bedroom at night, or an adult may sleep in the room with the child. A child who is threatened with chorea should not be constantly corrected or whipped. By judicious sympathy an attack of chorea may be averted. But a certain amount of firmness is necessary if one does not wish the child to grow up a pampered little pet. The services of a person of discretion who can tactfully and with judgment exercise this firmness are of inestimable value for such a child.

To sum up: Rest is the *sine qua non* of treatment in every case of chorea. In the more acute cases isolation is required, but in the mild cases this is unnecessary and may even be harmful. For the average case a liberal, easily digested diet is the best, and hydrotherapy may be useful. Massage, judiciously employed, is of undoubted value. Of drugs, acetyl-salicylic acid is the most reliable. It can be recommended on scientific grounds and because practical experience has proved its utility. In some cases tonic treatment is required, and arsenic in small doses is especially valuable. After recovery the child requires careful supervision, and the child's life must be very carefully regulated. On any indication of the return of the malady prompt measures must be enforced to check the attack.

Such, then, are some of the points in the treatment of chorea, a disease which, although not often fatal, is the cause of much annoyance to parents, and results in considerable suffering (largely mental) to the child.

THE THERAPEUTIC USE OF PASSIVE HYPEREMIA (BIER).

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Introduction. The present conception of inflammatory processes is, that as a result of injury—mechanical, thermal, bacterial—the tissues react locally, and exhibit certain phenomena which always have a distinctive tendency to produce repair of the damaged tissue. The old teaching, that inflammation is harmful and to be combated by every means at our command, has given place to the idea that reaction is necessary after injury, and if it does not occur measures should be taken to promote and increase it. In recent years we have had several important advances in treatment along these lines, and while the principles upon which they are based have been evolved by many workers, yet to Bier,[1] von Mikulicz, and Wright[2] we are indebted for passive hyperemia, methods of increasing the "resistance period," and opsonic therapy.

As a result of irritation to some more or less limited area of the body the phenomena of inflammation appear in a fairly well-regulated manner, and unless overcome by the greater power of the irritant, they inaugurate the sequence of events which we speak of as repair. The transudation of fluid from the vessels into the tissues, the emigration of leukocytes, the formation of new blood paths, and the stimulation and proliferation of the fixed connective-tissue cells are well known as part of the process of repair, and yet most of us are prone to forget that these very processes are not only capable of producing new tissue, but that they are also potent agencies in the removal of the irritant. By noting this fact, we are led to the conclusion that hyperemia and inflammation, up to a certain degree, are beneficial and should be artificially encouraged if the irritant itself does not stimulate nature to produce a degree of hyperemia sufficient to subdue the disease. At first thought the intense swelling, pain, local heat, and redness inseparable from acute inflammation would seem to indicate that the area of infection is suffering from an excessive reaction. But, as Adami[3] remarks: "The majority of cases of acute inflammation, cases which from their symptoms call for interference, are truly examples of inadequate reaction; the forces which the organism has been able to oppose to the irritant have been insufficient to neutralize it."

Before discussing the rationale of Bier's passive congestion, it might be well to consider the reactive processes generally. I know no better scheme than that of Adami into which they may be divided: (1) Reaction inadequate to neutralize the irritant and bring about

[1] Hyperämie als Heilmittel, Leipzig, 1907.
[2] Jour. Amer. Med. Assoc., 1907, xlix, 479, 567.
[3] Inflammation, New York, 1906.

repair; (2) reaction adequate for these purposes; and (3) excessive reaction. In the natural repair of fractures, the healing of incised wounds, etc., when the irritation is of mild grade and unaccompanied by severe signs or by pus formation the local reaction is adequate, and repair depends upon the healthy condition of the blood and, to a certain extent, of the nervous system. These are dependent, of course, upon a healthy coördination of all the component parts of the organism, as a whole, and the surgeon simply has to bring the wound or injury into such a condition by aseptic methods, etc., that an adequate local reaction is attained, and by regulating the excretory organs such reaction is preserved. No further treatment is necessary.

If the reaction is inadequate the surgeon should not attempt to lessen the inflammatory manifestations, but, on the contrary, they should be promoted and even increased in the hope of destroying the irritant locally. As has been remarked already, the symptoms of inflammation may be pronounced and an excessive reaction diagnosticated, but the spreading character or progressiveness of the infection and the general bodily reaction will easily show that the forces of nature are insufficient to cope with the irritant. This class is the one in which Bier's artificial hyperemia finds its use, and Wright's bacterins can be applied with most hope of success.

Excessive reaction is met, according to Adami, in only two conditions: (1) When one or other factor in the process is unduly exalted, the others being unduly low; and (2) in certain cases of what we may term neurotic and referred inflammation. Necrosis, ulceration, adhesions, or cicatrices are not examples of this class, because they simply mean "that the virus is being antagonized at great cost." Virulent infections and low resistance causing paralytic dilatation of the vessels without leukocytic emigration, exhuberant granulations, keloids, the swelling about a sprain of the ankle, etc., are examples in which the hyperemia requires to be lessened, not increased. With these facts in mind we are better able to take up the method whereby Bier induces hyperemia (*Stauungshyperämie*), of which Murphy remarks that there is nothing that has come into surgery in the last ten years as a practical application that appears to him to have as much value.

Of course, the idea is not new, as the production of congestion by cupping, by heat, and by counterirritation was done by the ancients, and, as Bier points out, Paré used the constricting bandage to produce callus formation in badly uniting fractures. Bruns, in 1886, reported five cases treated by congestion, Thomas, in 1886, used the method in 14 cases, and referred to it as "damming," and Helferich, in 1887, again recommended congestion as a stimulus to bone formation. Before these times, however, certain clinicians had stated that pulmonary tuberculosis and pulmonary stenosis often coincided, due to the anemia of the lung, and Rokitanksy enunciated the theory that mitral stenosis, with its chronic passive congestion of the lungs,

would prevent the development of tuberculosis. The latter statement has since been severely attacked, but they both came to Bier's notice and he proceeded at once (1892) to produce hyperemia in an effort to influence the course of tuberculous arthritis. Encouraged by the results obtained in the treatment of surgical tuberculosis, he enlarged the scope of his method, and applied it to acute and suppurating processes of all kinds. In 1905 Klapp,[4] from Bier's clinic, introduced the use of the various suction apparatus.

It is, of course, clear that we can increase the blood in a given area in two ways: (1) By producing a more active flow of arterial blood by accelerating the local circulation by the application of heat, counterirritants, etc. This is called active hyperemia and has been highly developed by Bier, being especially adapted to the treatment of chronic cases. (2) By obstructing the venous return, the blood is dammed back upon the capillaries, dilating them, and thus increasing the amount of blood (passive hyperemia). The suction apparatus produces both kinds of hyperemia, although Bier and Klapp believe the passive form to predominate. Even in the active form the dilatation of the bloodvessels causes slowing of the current, but as Bier teaches, both the arterial and venous hyperemia act so nearly alike as to make discussion on this point of little moment. Another fact has recently been brought to our attention by Bier, Schede, and others: that is, the fallacy of the old idea that by the use of cups, heat, iodine, blisters, etc., superficial congestion produces a deep anemia. This is often spoken of as "depletion of the part affected," and while this may occur to some degree in very mild forms of counter-irritation, in most cases hyperemia is probably produced.

Methods of Application. *Active Hyperemia.* Hot air has been used to produce hyperemia as long as the healing art has existed, and every one is familiar with the use of hot baths, hot fomentations, sun baths, steam baths, and the like. This method is particularly applicable to those chronic conditions in which thickenings, infiltrations, exudates, or adhesions exist, the result of a previous acute inflammation, as their absorption is much aided by flushing the parts with healthy blood. In certain neuralgias and other pains it is often of remarkable, although of uncertain benefit. Most of us are familiar with the well-known baking apparatus, and have used it with more or less success, depending upon the nature of the condition subjected to the heat. Bier has only simplified the method and narrowed its field of usefulness, thereby increasing the probability of successful treatment by its means. He recommends simple, inexpensive boxes made of wood free from resin, covered with cloth, and having the inner surface soaked in silicate to prevent burning. Openings are provided for the limbs, for a thermometer, and for the pipe from the apparatus generating the heat, which is simply a long sheet-iron

[4] Münch. med. Woch., 1905, No. 16.

funnel, under which an alcohol, gas, or electric lamp is placed. If gas is used, the lamp should always be lighted before placing it under the funnel. The lid should contain several holes to permit the escape of air, thus insuring dryness. Different-sized boxes, with differently placed openings are used for the various joints, although some degree of combination is possible.

The limb is placed in the box, the lamp lighted and placed under the funnel, and the temperature gradually raised to a point which is comfortable to the patient. This may be 150° F., or it may be even as high as 250° F. It should be borne in mind, however, that with increased heat the part becomes less and less sensitive, and at 250° to 300° F., sensation is almost nil, so that burns may occur. After one-half to one hour of treatment the lamp is turned off, and fifteen minutes later the limb may be removed from the box. The length of treatment and whether it be given daily or not depends upon the reaction.

Passive Hyperemia. No adequate English word has yet been devised as the equivalent of *Stauungshyperämie*, the usual designations used being passive, congestive, induced, or obstructive hyperemia. Allen and Meyer believe that the German word should be taken over bodily into our language, but as most of the articles upon the subject are classified in the indexes as passive hyperemia, I have preferred in this article to use that term. When the condition to be treated involves the head, extremities, scrotum, or testicles, the hyperemia is produced by means of an elastic bandage. When this is not feasible, as upon the back, chest, pelvis, and surface of the body generally, various forms of suction apparatus are used.

The elastic bandage used by Bier is made of soft rubber, 2½ inches wide and sufficiently long to be wrapped six or eight times around the limb, and then fastened by a safety pin, tapes, etc. The method he adopts is about as follows: If the condition to be treated is, for example, an infection of the foot, the bandage would be wound about the thigh, each time overlapping slightly. The bandage is put on sufficiently tight to hinder definitely the venous return, but not sufficiently so as to diminish the arterial flow, the latter point being determined by feeling the pulse below the obstruction. In a few minutes the limb begins to swell and becomes of a deep red color up to the bandage, the skin feeling warm to the touch. When the swelling is well established serum begins to escape freely from any wound which may be present. A little later the limb appears bluish or bluish red, but it should never be white or blotchy.

The swelling or œdema is always present if the bandage is continued for several hours, and need occasion no alarm if the pulse is felt below, the limb is warm, and pain is absent. This œdema, however, should not be allowed to persist, but between applications absorption should be promoted by elevating the limb and by massage. The bandage remains in situ for from one to twenty-two hours,

depending upon the condition for which treatment is instituted, but its position should be changed after about ten hours in one place. When long applications are used the skin may be protected by a soft flannel bandage beneath the rubber. The bandage must always be placed upon a healthy portion of the limb. When the patient's tissues are very sensitive, an inflatable tube may be used, similar to the arm band of the Stanton sphygmomanometer. Such a bandage has been described by Henle[5] and more recently by Wilson[6] and Grace.[7] The use of webbing instead of rubber has also been suggested.

Bier insists upon the utmost care and watchfulness, especially in the first day or two. The physician himself should attend to the treatment, as the method is capable in acute cases of doing almost as much harm if improperly applied, as it does good if correctly done. The progress of the case is gauged by the local appearances and symptoms—disappearance of pain, improvement in pulse, lowering of temperature, and finally the less and less response of œdema to the bandage. In the interval there may be a rise in temperature due to the setting free of toxins, and in septicemia the action upon the temperature may for some time be inappreciable.

The following must be rigidly avoided to insure success: Pain, paresthesia, white œdema, coldness of the skin, and obstruction of the arterial blood supply. All dressings and bandages must be removed the wound being protected by a loosely applied sterile towel; severe cases should be treated in bed; all pus should be evacuated by as many incisions as may be necessary, but these need not be as long as when passive hyperemia is not used, nor should the wound be packed or curetted; free incisions are only required when the circulation of the part is seriously impaired.[8]

Suction Apparatus. Although cupping has been practised since time immemorial to "relieve inflammation" and has been used in a more or less crude manner for years in the treatment of ulcers and infections, yet the method was not upon a scientific footing until Klapp, with the aid of an instrument maker, perfected the various shaped cups now on the market, and showed how they could be used with astounding success. These cups are devised to fit any part of the body, a furuncle on the neck, an abscess on the buttock, or a fistula at the knee-joint, for instance. The cup simply consists of a glass bell, with a heavy and usually curved rim to fit on a curved surface and a bulb attachment to exhaust the air. There are two essentials to be grasped before applying this method of treatment: (1) The diameter of the cup must exceed the area of infiltration; and (2) the amount of pressure must be regulated, because if the vacuum is too little, nothing is attained, and if too great, pain and white œdema are produced.

[5] Zentralb. f. Chir., 1904, No. 13.
[6] Jour. Amer. Med. Assoc., 1908, 1, 1122.
[7] New York Med. Jour., July 4, 1908.
[8] See remarks under Excessive Reaction.

The rim of the cup selected is greased with vaseline, and the bulb compressed in the right hand; the cup is then applied over the furuncle or sinus, and the pressure slowly released. The skin and underlying tissues are sucked into the cup; the hyperemia appears as a red or bluish coloration; pus, serum, and blood ooze from the wound. At the end of five minutes the cup is gently removed, the exudate wiped off, and the part allowed to rest for three minutes, whereupon the cup is again applied. This intermittent treatment is continued for forty or forty-five minutes, and then a simple dressing applied. After the united suction a limpid serum is constantly exuded, sometimes containing blood corpuscles and bacteria, in amounts reaching from 5 to 8 c.c. Treatment is continued every day, gradually decreasing the time of application as the discharge becomes thinner and the granulations become red and firm. Sometimes a scab or crust forms over the sinus which requires removal before beginning treatment. I find the use of Wright's sodium citrate chloride solution very advantageous in preventing clogging of the sinus with thick exudate. Squeezing, probing, curetting, or the use of drains is absolutely contra-indicated. Unless seen in the early stage, furuncles, carbuncles, suppurating lymph nodes, or abscesses should be opened by a small incision, and the cup applied immediately. Cold abscesses may safely be opened if due care is exercised in their protection, but should not be curetted, probed, or injected with iodoform emulsion; nor is immobilization necessary. Very large suction glasses are made for the treatment of puerperal mastitis, and are provided with a suction pump and stopcock arrangement. Finally, large and rather expensive glass vessels are made, into which a whole limb may be placed and suction applied. With the exception of a small one to fit the finger in the treatment of felons, they can be superseded by the elastic bandage. They can easily be made for the hand and wrist, however, by fitting a rubber sleeve to the opening of a large glass irrigator and a tube and stopcock to the outlet pipe. A Martin rubber bandage wound around the cuff makes it fit air-tight around the arm. A bicycle pump is used to produce the vacuum. Their best use is seen in orthopedic practice, as stiff joints may be gradually mobilized in a nearly painless manner.

Mode of Action. Bier does not ascribe the beneficial action of passive hyperemia to any one factor, and, owing to the complexity of theories regarding the protective process of the body against infection or toxemia, it is difficult to explain clearly, by scientific reasoning, how this method exactly acts. Bier, in his early publications, offered no explanation, except the flushing effect of the saturation of the tissues with serum, and compared the process to an irrigation system, in which the outflow is interferred with and the soil inundated to an overflow. In later communications he states his belief that the bacteria and their toxins are rendered harmless and further necrosis of tissues prevented by the superabundant nourishment. Much experi-

mentation has led to some elucidation of the problem. Bier groups the beneficial effects under the following headings:

1. *Relief of Pain.* This is particularly emphasized by Bier, and serves as the main criterion by which the progress of the case is recorded. The pressure of exudate is not now considered as the cause of continued pain, but this is thought to be due also to the irritation of the sensory nerve endings by toxins. Ritter[9] believes that hyperemia reduces the sensibility of tissues by diluting the toxins, and also by correcting the isotonic difference between the products of inflammation and the tissues in which they lie. The pain usually recurs in the intervals of treatment, at any rate, for the first few days, and in spite of the most careful application of the method I have several times in bone lesions produced an increase of pain by the constricting bandage.

2. *Bactericidal Action of the Serum.* The experimental proof which Bier offers in support of the action of the œdema upon the bacteria in the affected tissues is mostly based upon the findings of Nötzel,[10] in 1899. This experimenter injected fatal doses of anthrax and virulent streptococci into the tissues of 67 rabbits in which passive hyperemia had been produced. Fifty-one lived and 16 died, the latter, however, all had the "white œdema," which is to be strictly guarded against in producing the congestion. The control rabbits all died. Joseph,[11] Colley,[12] Hamburger,[13] and Lacquer[14] believe that the œdematous lymph, produced during periods of congestion, is markedly bactericidal. Baumgarten[15] agrees with Nötzel's findings if the dose of anthrax bacilli is not large, but he obtained negative results after injecting tubercle bacilli. While believing that there is a certain bactericidal action on the part of the accumulated blood serum, he suggests that this is not vigorous and that the death of bacteria may be due to the lack of nourishment in the media. This seems to me to be based on false premises, in view of the well-known predisposition of chronic œdema to bacterial invasion.

On the other hand, many experimenters have failed to obtain this bactericidal action, among the more recent being Wrede,[16] Frangenheim,[17] Graff,[18] and Walther.[19] Wrede, in particular, believes that the bactericidal power is uncertain and can be used only in a limited way, and in 50 cases he repeatedly examined the incised focus and was unable to demonstrate by enumeration a marked decrease in the organisms. He also examined unopened foci, joints, for

[9] Arch. f. klin. Chir., Band lxviii, S. 429.
[10] Arch. f. klin. Chir., Band lx, Heft 1
[11] Münch. med. Woch., 1906, No. 48, S. 2370.
[12] Virchow's Arch., 1899, Band clvi, S. 329.
[13] Ibid., 1906, No. 6.
[14] Zeit. f. Exper. Path. and Therap., 1905, Band x.
[15] Münch. med. Woch., 1906, Band iii, No. 48.
[16] Surg., Gynec., and Obstet., 1908, vii, 288.
[17] Arch. f. klin. Chir., 1908, Band lxxxvii, Heft 2.
[18] Beit. z. klin. Chir., 1908, Band lix, Heft 3.
[19] Virchow's Archiv, 1908, Band cxciv, Heft 1.

instance, which had been treated for some time by passive hyperemia, and found many actively growing bacteria.

Without going into the controversy in detail, it may suffice to point out that in all probability the success of this method of treatment depends upon the coincident working of increased serum, bacteriolysis, and phagocytosis. By increasing the pressure in the capilaries the focus of infection is flooded by a lymph having antitryptic and opsonic powers, arresting the further destructive action of ferments and inhibiting bacterial growth. When the bandage is removed the dammed circulation reëstablishes itself; the lymph moves out of the affected part, liberating more or less endotoxin, which exerts an influence upon the antibactericidal power of the blood generally by the stimulation of antitoxins, alexins, opsonins, etc. If any of the factors of this relation are altered the results of the method must vary. Thus, the period of the so-called "positive phase" is the most favorable for the success of Bier's method, as the blood serum comes to the focus of infection charged with bactericidal and bacteriolytic properties, and the leukocytes and opsonins are powerfully phagocytic. If the organism, on the other hand, is depressed and in the so-called "negative phase," passive hyperemia may fail in its purpose, or, what is more important, the liberation of the endotoxins in excessive amount, during the pause, may seriously affect the condition of the patient. For these reasons I believe that we will shortly have to modify the extravagant and universal claims of success for this treatment, and so balance the surgical incision, the artificial use of opsonins, and the increased lymph flow by passive hyperemia that they will each have their applications singly or together. At any rate, it seems as though, just as asepsis has succeeded antisepsis in operative technique, so will a more rational treatment of acute and chronic suppuration based on modern scientific principles succeed the douching of wounds with chemicals and their irritation by the continuous presence of foreign substances. It is well known that a film of necrosis results from the use of strong chemicals injuring the histological elements, and it should be equally well understood, as stated by Wright, "that the antiseptic will directly antagonize the protective forces which the living organism has at command, will paralyze the phagocytes, and will abolish the antibacterial power of the body fluids."

The papers published by Lexer[20] and by Wolff-Eisner,[21] in 1906, are very suggestive and emphasize the importance of recognizing the danger of the toxins produced by the bacteriolysis in severe cases. During the interval or pause in the treatment the œdema disappears and "the body is flooded by the œdema fluid which carries with it the soluble substance of the inflammatory process" (Wrede). This is often evident clinically by the rise in temperature and some-

[20] Münch. med. Woch., Band liii, No. 14.

[21] Ibid., Band liii, No. 23.

times by chills, etc. Lexer, therefore, points out that this injurious action may be avoided in severe acute cases, by large and early incisions in place of the small ones recommended by Bier. Such treatment also prevents the spreading of the endotoxins into hitherto intact areas. Wolff-Eisner states that the indications for Bier's hyperemia are the same as for the bactericidal serums, the hyperemia being most favorable when complete bacteriolysis is present, and the number of bacteria small. This is seen in mild cases and in severe cases treated early. He also observed that sometimes in streptococcic infection, either pure or mixed with staphycococci, the Bier treatment failed or actually caused a general exacerbation.

3. *The Resorption of Toxic Products.* Bier advances many ideas from physiological experiments to support this effect of hyperemia, of course basing his contention upon the well-known increase of lymph flow as the result of venous obstruction. Thus, Joseph measured the amount of œdema by the displacement seen when the limb is placed in a cylinder of water before and after the constriction. In one experiment he found that 450 c.c. of fluid passed out of the arm. If we are able to eliminate the effect of the liberated toxins upon the organism, these results would be ideal for all cases, but, as remarked before, the endotoxins must, if excessive, be reckoned with.

4. *The Softening and Solution of Blood Coagula and Exudate.* Bier states that adhesions, cicatrices, and contractions about joints become soluble under the influence of enzymes in the lymph with which they are flooded, and then absorbed. The flooding of unhealthy tissue during the intermittent œdema is followed by its absorption in the intervals and its replacement by a large amount of new healthy tissue. It is probable, also, that the increased number of phagocytes is a very important factor in favoring absorption.

5. *Increased Nutrition.* But little need be said on this point, as it has been believed since Virchow that hyperemia increases nutrition. The zone of reaction and cell growth usually seen about a focus of necrosis is evidence that the cells are actively assimilating. Care must be exercised not to prolong the hyperemia unduly nor to allow a condition of chronic œdema to occur, in which events the vitality of the tissues will be lessened, and the process become generalized.

CLINICAL APPLICATION. To attempt even a brief description of the various diseases for which hyperemia, active and passive, has been recommended would far transgress the limits of this paper. It suffices to state that from meningitis to gout and back again the list includes nearly every infection or nutritional disorder to which the body is heir.[22] The following are selected as types of the more

[22] For a full description of these the reader is referred to Bier's Hyperämie als Heilmittel, where over 200 pages are devoted to a discussion of the clinical uses of hyperemia.

common conditions to which the method is applicable. In general, it may be stated, "that for conditions due to bacterial invasion the passive form of hyperemia is to be used, while for the non-bacterial conditions the active variety is applicable."

The beginner should always bear in mind the possible danger of manipulating the blood stream, and at first limit his endeavors to early acute and subacute inflammations, especially those that ordinarily give a good prognosis. Furuncles, carbuncles, paronychias, felons, mastitis, lymphadenitis, etc., are all disorders in which suction can be employed with great benefit. Diffuse inflammatory infiltrations, unaccompanied by softening, and especially when the streptococcus is believed to be the causative organism, are not suitable for the treatment. If these are accompanied by fever and other evidence of constitutional disturbance, or if the process is rapidly spreading locally, passive hyperemia only does harm. In wide open accidental and operative wounds the method is of value. In general, it may be stated that disease of bone is very rebellious to the treatment, as it is, however, to any other method, because of the impossibility of producing any degree of œdema in the dense tissue.

Tuberculous Arthritis. In the treatment of this affection, as well as in all forms of surgical tuberculosis, passive hyperemia alone must be used and never hot air. The treatment aims slowly to produce a connective-tissue overgrowth, which replaces the tuberculous granulations; consequently the method requires much patience in its application, as frequently twelve or fourteen months are required to produce a cure. Some recent researches by Felegyhazi[23] show that in tuberculous sinuses examined microscopically the effect of passive hyperemia is to produce an increased formation of connective tissue. He believes that while phagocytosis is active in suppressing any mixed infection present, the result of the treatment depends upon the walling in of the tuberculous foci by the connective tissue. He also pertinently remarks that he is uncertain, until further experiments have been carried out, whether these submerged bacilli are eventually destroyed, or whether a trauma may set them free at a future date. The bandage is applied about the thigh or arm sufficiently tight to produce a bluish-red coloration, and, as a general rule, should remain in place for one hour twice daily. This may be decreased if found necessary or may be increased to two hours twice daily if better results are obtained by the longer application. Occasionally it may be found advisable to stop the hyperemia for a few days if the condition remains stationary. Great care should be taken of the part of the limb where the bandage is being applied, frequent changes of the point of application and gentle massage with oil being advisable. While complete immobilization is to be avoided, the patient should not subject the limb to any weight or strain, particularly in the early

[23] Deut. Zeit. f. Chir., 1908, Band xciii, Heft. 5.

stages. Cold abscesses frequently occur and must be opened as soon as detected, treated by the suction glasses in the manner described previously, and protected from contamination. As contra-indications, may be mentioned commencing amyloid disease, advanced phthisis, large abscesses filling the whole joint, faulty position of the joint with bony ankylosis, and "arthritis tuberculosa exsudativa" (hydrops). Several years ago Bier claimed 88 per cent. of cures in the hand and wrist, 72.7 per cent. in the elbow, 61.5 per cent in the foot and ankle, and 23 per cent. in the knee condition. The cold abscesses arising from Pott's disease of the vertebræ should not be subjected to suction unless it is absolutely necessary to open them, when the cups may be used to prevent mixed infection.

Gonorrhœal Arthritis. This disease is considered one of the most favorable for hyperemic treatment, not only because of the good result ultimately obtained, but also because of the early relief of the excruciating pain with which it is accompanied. It requires considerable judgment in interpreting whether good or harm is resulting and the method must be used with caution. The bandage should be applied twice in the twenty-four hours for ten or eleven hours each time, and during the pauses the œdema must be made to disappear by elevation and gentle massage, at which time the effect of treatment must be carefully scrutinized. Distention of the joint with pus or seropurulent fluid must be prevented by aspiration followed by irrigation with saline solution. Baetzner[24] reports 40 cases so treated in Bier's clinic, in which the duration of the condition was shortened, pain promptly relieved, early immobilization obtained, and ankylosis prevented in all the cases. Local treatment of the posterior urethra, prostate, etc., should, of course, be carried out at the same time.

Sufficient information is given in the preceding paragraphs to enable the practitioner to understand the principles and mode of application of this method of treatment. Especial emphasis must again be laid upon the dangers which may occur by its indiscriminate and unskilful use in acute infections, and, on the other hand, praise must be given in no stinted manner to the efforts of Bier to bring the method to the attention of the medical world. For sixteen years he has persistently advocated the use of hyperemia, both active and passive, and now, as the successor to von Bergmann at Berlin, he is in a position to command attention. In any inflammatory lesion where exudate, necrotic or plastic, is present, or whenever bacterial invasion of the tissues requires to be checked, the method is of more or less distinct value if it can be applied, but it must simply be regarded as an adjuvant to other older and well-known methods, and not as a panacea for all ills.

[24] Deut. Zeit. f. Chir., 1908, xciii, Heft. 1.

THE DIAGNOSIS AND SURGICAL TREATMENT OF INGUINAL HERNIA.

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Having in a previous paper[1] discussed the etiology and pathology of inguinal hernia, we purpose now to discuss the diagnosis and surgical treatment, directing attention first to reducible and then to irreducible hernia.

Diagnosis. A reducible hernia is either complete or incomplete. If it descends into the scrotum in the male, or the labium in the female, it is a complete hernia. If it remains in the inguinal canal, it is an incomplete hernia or bubonocele.

There are a few things that may be confounded with an incomplete hernia. No doubt a retained testis and hydrocele of the cord are the two conditions most likely to give trouble. If the scrotum be examined carefully and it is ascertained that the two testes are where they should be, then, of course, an ectopic testis is eliminated. If, on the contrary, one is absent, the diagnosis is reasonably clear.

A hydrocele of the cord may easily be mistaken for a hernia, yet there are differential signs which should keep one from going astray. While both hydrocele of the cord and hernia give an impulse on coughing, there is a difference in the character of the impulse. In hernia the impact is caused by a more or less solid body coming in contact with the finger. It will vary somewhat according as the hernia is of the omentum or of the gut; but in either event, it will be different from the peculiar impulse given by a fluid, as in hydrocele of the cord. Then, again, hydrocele gives fluctuation, which is not the case with hernia. Moreover, the hydrocele is tense, pyriform in shape, and gives evidence of a tightly distended sac, which again is not the case with hernia. Furthermore, hydrocele of the cord is far more common on the right side than on the left. This is also somewhat true of hernia, but the disproportion is not so great as it is with hydrocele. Generally, in reducible bubonocele the tumor disappears when the patient is in the recumbent position. Hydrocele of the cord usually does not.

In a complete reducible hernia there are several conditions that

[1] Amer. Jour. Med. Sci., 1909, cxxxviii, 853.

may with difficulty be differentiated. Those most likely to give trouble are be congenitial hydrocele, varicocele, and varix of the saphenous vein. Congenital hydrocele is undoubtedly more likely to cause difficulty in its differentiation than anything else. In both conditions the tumor reduces itself, or disappears, when the patient lies down; there is also an impulse on coughing in both, but the impulse is due to a more or less solid substance in hernia and to a fluid in hydrocele; there will be fluctuation in a hydrocele, but none in a hernia. The one crucial test, and by it one can always differentiate between the two, is that while both tumors disappear when the patient is in the recumbent position, if the finger be placed over the inguinal ring and the patient instructed to stand up, the hernia does not descend, but the hydrocele speedily reappears, because the fluid gets past the finger, whereas the more solid contents of the hernia do not.

Varicocele may easily be confounded with hernia. The last two cases of varicocele operated upon by one of us were diagnosticated as herniæ by competent physicians. Hernia is very often, indeed in the majority of cases, on the right side; varicocele is nearly always a left-sided affection. Moreover, varicocele is an affection of adolescence, being very common between the fifteenth and twenty-fifth years. Hernia, on the contrary, is common in very young children and in old age. Still, however, there will be many herniæ encountered in young men, in whom varicocele is frequent. Both disappear when the patient is recumbent; both tumors give a distinct impulse on coughing, but the impulse is different. A more or less solid substance causes the impact against the finger in hernia, whereas varicocele is recognized by the soft purring made by the blood which is forced through the vessels against the finger. Then again, the descent of a hernia can be prevented when the patient is erect by pressing the finger over the internal ring and making pressure. The return of the varicocele, however, cannot thus be prevented.

A varix of the saphenous vein might, but should not be, mistaken for an inguinal hernia, though it is very often mistaken for a femoral hernia. The same rule applies to making the patient lie down, placing the finger over the internal ring, and asking the patient to stand erect. The hernia does not descend, whereas the varix speedily reforms. Again, varix of the saphenous vein nearly always is accompanied by varicosity of other veins lower down in the leg. Hence, if one only examines carefully, there should be no trouble in differentiating between either a femoral or inguinal hernia and a varix of the saphenous vein.

As difficult as it may be to recognize reducible hernia, incomplete or complete, it is far more difficult at times to differentiate between irreducible hernia and other conditions which oftentimes simulate it. The condition which is more likely to confound one than any-

thing else is hydrocele. A large number of cases of hydrocele are treated for hernia, and vice versa, and although it does not make so much difference if one treats a hydrocele for a hernia, it makes every difference if one undertakes to do for a hernia what is often done for a hydrocele. Therefore, we must be able to differentiate between these two conditions.

The swelling in a hernia begins above, in the inguinal canal, and descends into the scrotum. The swelling in a hydrocele begins below, in the tunica vaginalis, and extends upward. The testis in a complete hernia is forced to the bottom of the scrotum. In hydrocele it is situated posteriorly and at the junction of the lower and middle thirds of the scrotum. A hernia gives a distinct impulse on coughing; a hydrocele gives no impulse. A hernia is opaque to light; a hydrocele is more or less translucent, though in a hydrocele with a thick sac there may be little or no translucency. A hernia gives no fluctuation; a hydrocele does give fluctuation. The tumor in a hernia descends well into the scrotum and hangs down straight between the legs. A hydrocele is pyriform in shape and stands out more or less from the body.

Another condition, one that we should place next to hydrocele, which may give trouble, is orchitis, either acute, subacute, or chronic. The exquisite tenderness and other local evidences of inflammation, the general fever, and particularly the history of the case—that is, that it follows either trauma or infectious disease—ought to keep one from making an error in differentiating between hernia and orchitis. In the subacute or chronic varieties, however, there will be no redness of the skin and other evidences of local inflammation, and no accompanying systemic fever; hence the difficulty is greater. But the history of the case, there having been certain predisposing causes, such as gonorrhœa, tuberculosis, or syphilis, will largely prevent a mistake in diagnosis. Moreover, the testis, when enlarged, nearly always gives pain, oftentimes a peculiar nausea and faintness which follows handling the organ, and that in itself is most suggestive. Then, there is no impulse on coughing in an enlarged testis; there is always an impulse in hernia.

Another condition which might be mistaken for hernia is hematocele, or blood in the scrotum. It is not an easy mistake to make, and we believe that the books exaggerate the liability to err in this case. The history of a hematocele shows that it is nearly always sudden, and is caused by a blow, a kick, or trauma of some kind. Therefore, the tumor rapidly forms, and in addition there will very generally be an amount of discoloration of the part, which will at once enable one to recognize that there is blood beneath the skin.

In an irreducible hernia there will be either omentum, intestine, or both, retained in the sac, and, moreover, the contents will be prevented from returning to the abdomen even when the patient lies down, though an attempt is made to effect reduction by taxis.

Adenitis may also be easily confounded with irreducible hernia. The acute variety will, as a rule, give little trouble, because the exquisite tenderness of the inflamed lymphatic glands, the accompanying redness and signs of inflammation, the systemic fever, and above all, the history of the case showing that there has been acute infectious disease, point clearly to the nature of the affection. In the more subacute condition, though, particularly in tuberculosis, when there are one or more glands fused together, one might easily make a mistake. The history of the case; the fact that one can, as a rule, satisfy one's self that the enlarged glands are *near*, but not right *at* the external ring, and that the little finger can be insinuated into the inguinal canal, showing that it is empty in adenitis, whereas it will be occupied by the sac in a hernia, should prevent any mistake. It must be remembered that the neck of the sac in hernia must be internal to the spine of the pubis, whereas in adenitis the enlarged glands will nearly always be to the outside of the external ring.

Another condition that possibly will not be thought of is lipoma, or fatty tumor. The dough-like, inelastic lipoma at times may very closely simulate an irreducible omental hernia, for in such a hernia we have the same kind of tissue to deal with, to wit, fat. The lipoma, however, is more movable and situated in all probability more or less remotely from the inguinal canal. Its very location should enable one to recognize that it is a lipoma and not a hernia. Then, again, lipomas in this location are extremely rare; herniæ, very common.

Another condition that should always be thought of is cold abscess. Cold abscesses point very frequently at the inner aspect of the thigh. They are more likely to be confounded with a femoral than an inguinal hernia, because they usually point below Poupart's ligament; but they may point above Poupart's ligament, and then one may confound them with an irreducible inguinal hernia. What is the difference between them? In the first place the impulse on coughing, while marked in both, is different in a way. The hernia gives an impulse due to a more or less solid body. In abscess there is fluid, so that fluctuation may be elicited, whereas in hernia it cannot be obtained.

But there is a better way to differentiate between them. With the patient in the recumbent position, make very deep pressure with one hand over the lower part of the abdomen and with the other hand palpate the swelling. If it is an abscess, the fluid will disappear. It does not disappear into the abdominal cavity, however, but passes backward and upward behind the peritoneum; and then, as the swelling below is manipulated with one hand, and that in the loin with the other, a decided sense of fluctuation is obtained, which at once indicates that the two communicate.

There is also another way: examine carefully, and it will nearly

always be found that a cold abscess is accompanied by disease of the bones, showing itself either as spinal curvature or disease of the ilium. In other words, a cold abscess means accompanying disease of the bone somewhere; and if it is looked for, it will be found.

As difficult as it may be to differentiate between the foregoing conditions, there may be greater difficulty in differentiating between an irreducible inguinal hernia and an irreducible femoral hernia. In a stout, fleshy woman the diagnosis is especially difficult to make. There are two or three ways by which the two conditions can be differentiated. In an inguinal hernia the tumor appears above Poupart's ligament, because it must come out at the external abdominal ring. In femoral hernia it appears below Poupart's ligament, emerging at the saphenous opening, But while that is true, the hernia in the femoral variety is prevented from descending by the fascia lata. Therefore, it rolls up in the direction of least resistance, and soon gets above Poupart's ligament. Even so, one can tell the difference if one is careful. Place a finger on the spine of the pubis, which is external to the ring. In an inguinal hernia the neck of the sac must be, and can only be, internal to the finger. In femoral hernia the neck of the sac is well external to the finger, and at times may even be pulled out almost as far as the spine of the ilium. A third test is made by examining the inguinal canal with the finger, which is inserted into it through the external ring. In femoral hernia the canal will be found to contain only its normal contents, either the spermatic cord in the male, or the round ligament in the female. In an inguinal hernia, however, the inguinal canal is occupied by the sac and hernial contents.

Having thus gone over the most important diagnostic considerations, we will now discuss the several varieties of hernia which may be confounded one with another.

By an obstructed hernia is meant one in which the function of the gut is interfered with—and in a vast majority of instances it is the large gut which is affected—the intestine being distended with more or less hardened feces. What will be the symptoms of obstructed hernia? All the signs and symptoms of irreducible hernia in the first place, and in addition thereto, certain signs more or less characteristic of obstruction. Thus, nausea will nearly always be present and frequently there will also be vomiting, which, however, is easily controlled by withholding food. In other words, the patient empties the contents of the stomach, so that if food is withheld, vomiting ceases. There is more or less pain in an obstructed hernia. The pain, however, is never severe, but it is a more or less general, vague, indefinable sense of discomfort.

There is an impulse on coughing in an obstructed hernia, yet it is different from the impulse of irreducible hernia. It is slight, may be found only at the neck, and in trying to elicit this sign one should delicately grasp the neck of the hernia and ask the patient

to cough, when an impulse will be felt. Sometimes this is the only possible way that one can differentiate between an obstructed and a strangulated hernia.

There will be constipation in an obstructed hernia, but the constipation is relative, not absolute. The lower bowel may act more or less spontaneously, but it never empties itself, only allowing a certain portion of its contents to pass. There will always be passage of gas, however, and if a clear history of this can be elicited, we have another valuable sign which tells plainly enough that the condition is obstruction and not strangulation—if we except the extremely rare variety, Richter's hernia.

Now as regards inflamed hernia. A patient has an irreducible hernia; he receives a blow, a kick, or he falls, for instance, astride the rung of a ladder—in other words, sustains trauma. There will be certain signs in an inflammed hernia that one would not expect in either irreducible or obstructed hernia. Manifestly, the pain will be greater, and it will be local. It will not be that vague, ill-defined, general pain, characteristic of obstruction; but it will be largely confined to the inflamed sac and its contents. The hernia will also be, perhaps, exquisitely tender to the touch, and if the temperature be taken, it will be found that the patient has fever, not marked, but an elevation of a degree or a degree and a half. There will also be an impulse on coughing, and other symptoms that will be practically the same as in obstructed hernia.

How are we to recognize strangulated hernia? Of all herniæ, this is the most important to appreciate and treat promptly. An obstructed hernia may cure itself, an inflamed hernia may likewise do so, but a strangulated hernia practically never does so, and death results without surgical intervention. How can it be diagnosticated? In the first place, an obstructed hernia borders closely on strangulation. Hence it is not surprising that an obstructed hernia of today may become a strangulated hernia tomorrow. In other words, obstruction merges into strangulation, because the hardened feces accumulate in the distended gut and not only interfere with the function thereof, but, if it be very much distended with hardened feces, its circulation at the neck may be interfered with by pressure, and when both function and circulation are interfered with strangulation ensues.

As soon as strangulation takes place there will be, as a rule, rather pronounced shock. We say "as a rule" advisedly, for the reason that we do not believe it is always well marked. We are satisfied that the text-books nearly all overemphasize the degree of shock present in strangulated hernia. Certainly in a large percentage of the cases seen by one of us there was no shock at all. Shock may possibly pass away before the physician, especially the surgeon, is called in. We doubt not if one could see a strangulated hernia early, as soon as it begins, that there would practically

always be more or less evidence of shock. It is easy to understand why that is so. Shock manifests itself by a subnormal temperature, weakened pulse, cold, clammy skin, pale countenance, and pinched features. Almost at once the patient begins to vomit—and here the character of the vomiting is very different from that which occurs in obstructed hernia. It is projectile, continues in spite of everything that is done, the patient first vomiting the contents of the stomach, later on bile, and later still the contents of the intestines.

There will be a peculiar pain about a strangulated hernia. It is uncertain and variable, at times so great as to be accompanied by marked shock, at other times scarcely present at all. It may be steady or intermittent, but usually is intermittent and colicky in character.

TREATMENT. We will consider, first, the treatment of the complications of hernia. The first is irreducibility. We may say in general, that all irreducible herniæ demand a radical-cure operation, unless there are distinct contra-indications to any operative procedure. If the patient be very old and the hernia very large (more frequently the case in umbilical rather than inguinal hernia), an operation may be exceedingly dangerous. Then, again, if the patient has disease of the kidneys, or other organic disease, it is better not to operate, but to be content with supporting the hernia by means of a bag, a hinged-cup truss, or other suitable appliance. But without such complications an irreducible hernia invariably calls for an operation, because of the fact that it may in time become inflamed, obstructed, or strangulated.

It should be remembered that such herniæ are necessarily exposed to all forms of traumatism and that a fall or blow may cause either rupture of the gut, inflammation, or strangulation. We have known rupture of an irreducible hernia to occur as the result of the kick of a horse, and we have not infrequently seen inflammation excited by various kinds of trauma, particularly by ill-fitting and injudiciously worn trusses. So, while one may hesitate to perform a radical cure operation for a reducible hernia, and rightly so, there is practically no choice in the irreducible variety. The patient's safety will be best subserved by an operation in which there is practically no danger. Moreover, his comfort will be enormously enhanced thereby; hence it is vastly more important to operate upon irreducible than upon reducible herniæ.

The next complication is obstruction, or so called incarceration. How is it to be treated? In the first place, it should be remembered that obstruction is nearly always preceded for a greater or less time by irreducibility. The hernia is first irreducible, subsequently becoming also *obstructed*. Therefore, in its treatment one should have in mind relief to the obstruction, and not overcoming irreducibility, because that is practically impossible. This is not to be done by purgatives, as might be supposed, but by high enemas

of warm olive oil, so that the feces may be softened, and in this way the obstruction overcome, it being due, as a rule, to hardened feces in the sigmoid or some other portion of the large gut. It is only after the large intestines have been moved well by enemas that purgatives are to be considered at all. Even then a non-irritating purgative such as castor oil is indicated. A restricted diet, consisting of food with little residue, is of the utmost importance if food is to be given at all.

Inflamed hernia is to be treated by absolute rest in bed and by local applications, either hot or cold. With the average adult who is more or less vigorous cold is preferable to heat. An ice bag over the hernia gives great comfort and lessens the inflammation. In old people, however, cold applications are of questionable utility. The vitality of such patients is below par, and the prolonged or injudicious use of cold applications may easily cause gangrene in patients of advanced age. Therefore, when in doubt as to whether cold or hot applications should be used, one had better decide in favor of the latter. They should be changed frequently, every five minutes, so as to get the best possible results. In addition to local applications, enemas may be employed, as in obstructed hernia. One may be driven to give what one would hardly think of giving in an obstructed hernia, that is, a small amount of opium to relieve pain.

If inflammation passes on to strangulation, or if there is doubt as to whether or not strangulation has occurred, the safety of the patient will be best subserved by making an incision, establishing drainage, and inspecting carefully the condition of the gut.

We will finally consider the most important of all accidents associated with hernia—strangulation. There are two ways of treating strangulated hernia. One is by manipulation, or taxis, as it is called; the second is by herniotomy, or cutting the constriction and relieving the imprisoned gut. The usual method is to employ taxis in practically all strangulated herniæ before resorting to herniotomy. Formerly, this practice was well nigh universal; in pre-antiseptic days it was used far more extensively than it is at the present time, because of the mortality following herniotomy. There is, however, a growing tendency with many surgeons to esteem lightly the value of taxis; moreover, its dangers are manifest, and if employed, it should only be to a very limited extent. In certain cases taxis should not be employed at all; thus, if the hernia was previously irreducible, it is manifestly absurd to use taxis, for if irreducible before it became strangulated, it would be impossible to reduce it with strangulation superadded.

Then, again, if the hernia has been strangulated for some hours, particularly if it be a small, tense hernia, the danger of attempting to reduce it by taxis is very great indeed, since taxis, however delicately made and however skilled the surgeon employing it,

may cause the gut, already softened by inflammation and distended by feces and gas within, to rupture; this accident would almost certainly be lethal. If the hernia has been strangulated for some hours, taxis would be not only futile, but positively dangerous. This is true of all herniæ, but it is especially true of a small, tense, femoral hernia.

How often does taxis succeed in reducing a strangulated hernia? In thirty years' experience one of us has reduced but one undoubtedly strangulated hernia by taxis. Many others which were thought by those in attendance to be strangulated, but which in reality were not, have been reduced. The idea that one gets from reading text-books as to the value of taxis is absolutely wrong, and in the judgment of modern surgeons it is to be employed with the utmost caution, if at all, and only in well-selected cases.

There are certain accidents that may follow taxis. In the first place a loop of intestine which is nipped tightly at the neck and distended with gas may very easily rupture, just as a tightly distended rubber bag may burst when incautiously pressed upon. Second, reduction *en masse* may follow. By this is meant that an injudicious attempt at reduction has resulted in both sac and contents being pushed back into the abdominal cavity, but that the constriction which is causing the strangulation is unrelieved. In other words, although the tumor disappears into the abdomen, the symptoms of strangulation continue, and it is evident that the constriction was within the sac, and consequently has not been relieved. In such circumstances the patient dies unless abdominal section is performed. Third, the gut may be so injured, although not ruptured, at the time it goes back into the abdominal cavity, that as a result of such bruising and the inflammation which follows, there is subsequently a perforation of the gut, which necessarily means a fatal peritonitis. One of us has personal knowledge of a case in which spontaneous rupture of the intestine occurred a week after reduction by taxis. This was demonstrated at autopsy.

Taxis should never be employed until the consent of the patient for a herniotomy has been obtained, in the event of it proving fruitless. The relaxation following an anesthetic is necessary for a successful attempt at taxis. Should such an attempt prove unsuccessful, as it generally will, it is manifestly unwise to allow the patient to come from under the anesthetic before resorting to herniotomy. Taxis, if employed at all, should not be continued more than five minutes. If successful, and the hernia is an enterocele, it disappears into the abdomen with an audible gurgling sound, indicating reduction. If an epiplocele, there is no noise, but a gradual disappearance of the swelling.

The best way to employ taxis is gently to grasp the neck of the sac between the thumb and index finger of the *left* hand, and then, with the thumb, index, and middle fingers of the *right* hand, the

fundus or expanded portion of the swelling is gently manipulated. At first it is pulled upon for the purpose of disengaging the neck. Afterward it is carefully compressed so as to displace feces and gas, thereby reducing the volume of the hernia, so that the imprisoned gut and omentum may escape.

HERNIOTOMY. By herniotomy, or, as it is sometimes called, kelotomy, is understood cutting the constriction and replacing the damaged gut or omentum, if they are in proper condition, into the abdominal cavity.

There is little danger in the procedure, scarcely more than in a simple radical-cure operation; but the condition of the patient and hernial contents is very different, and this explains the mortality. If the operation is delayed, as is so often the case, owing first to a belated diagnosis, and second, to procrastination on the part of the physician, the mortality is necessarily great. If performed after twelve hours, such damage to the intestine will have ensued that the mortality is not less than 25 per cent. If done after twenty-four hours, the mortality is 50 per cent. Therefore, the one thing to have in mind is to operate as soon as possible after the diagnosis is made. If a case is seen during the day, the sun should never be allowed to set before the operation is done. If seen at night, even though it be in the "wee sma' hours of morn," the sun should never be allowed to rise before relief is given.

Technique. The incision should be made above and parallel with Poupart's ligament—in other words, over the *neck*, where the strangulation in all probability exists, and not low down in the scrotum. In the first place, one can get at and relieve the constriction better; in the second place, the field of operation is a more aseptic one.

Cut carefully down until the sac is reached, it being recognized without difficulty by its lustre and the arborescent arrangement of its bloodvessels. It should not be difficult to differentiate between the thin sac above and the intestine beneath, as the latter is thick, softer, darker in color, velvety to the touch, and wanting in the larger bloodvessels found in the sac. If in doubt, delicate palpation will usually elicit fluctuation beneath the sac, due to fluid almost invariably present. In certain cases of doubt, a hypodermic needle may be used most judiciously, being introduced in a slanting direction, so as to avoid probable injury to the gut beneath.

The sac having been identified, it is to be freely laid open to the extent of the superficial wound. Fluid at times escapes, and its color, odor, and general appearance indicate fairly well the condition of the imprisoned bowel. If clear and free from odor, the probability is that little damage has resulted. If the strangulation has lasted several hours and the constriction is tight, the fluid may be more or less brownish, or dark colored, and contain flakes of lymph. Even so, the chances are still favorable. If, however,

the fluid be very thick, dark and ill-smelling, it is suggestive at least of impending, if not actual, gangrene.

The next step is cutting the constriction. In inguinal and umbilical hernia this can be done in two ways: (1) From without inward; (2) from within outward. Although the latter method has been, and still is, very generally practised, it is less safe for several reasons than cutting from without inward. The latter has the advantage of being done deliberately under the eye. Therefore, damage to the gut is unlikely. If the constriction is cut from below upward, the distended and inflamed bowel may be easily punctured by either the grooved director or knife as they are introduced beneath the constriction. We consider this an important step in the operation of kelotomy and insist that the constriction both in inguinal and umbilical hernia should always be cut from without inward, for not only is the bowel less endangered thereby, but there is considerably less risk from hemorrhage. One is open, the other subcutaneous surgery. Unfortunately, the old method of cutting from within outward must, for anatomical reasons, necessarily obtain in femoral hernia.

The only vessels endangered in strangulated inguinal hernia are the deep epigastric artery and vein. These will be avoided by cutting the constriction in a direction parallel to the vessels, that is to say, directly upward. True it is that one could safely cut externally in indirect hernia, internally in direct hernia, but as it is simply impossible to say definitely in every case that the hernia is either the one or the other, the constriction should be cut in a direction equally safe for both.

Where will the constriction usually be found? It is most frequently at the external ring. We desire to emphasize this fact, as many of the older writers insisted too much upon the probability of the strangulation being at the internal ring.

The constriction having been relieved, the appearance of the strangulated loop of intestine at once improves both in color and temperature. In truth, a deep mahogany or rose color may quickly pass away as soon as arterial blood is allowed to enter and, *pari passu*, the venous blood to escape. With a change in appearance will be a return to the normal temperature. Before relief of the strangulation, the gut is cold and clammy. If both color and temperature quickly improve, there is little risk in returning the extruded bowel to the abdominal cavity. Per contra, if after waiting ten minutes or longer, the bowel, though improving somewhat, still remains discolored, dull, lustreless, and its temperature subnormal, there is at least a question as to its viability; therefore, if it is to be returned to the abdominal cavity, it should be anchored at the internal ring by placing a catgut suture through its mesentery, so that in case of subsequent perforation it may break *externally*, and not into the abdominal cavity. A better plan, in our judgment,

is to leave the herniated bowel outside of the cavity and to apply hot salt solution frequently for twenty-four hours. This not only favors its vitality, but certainly lessens the danger of general peritonitis.

If, after waiting a reasonable length of time, there is no apparent improvement in the bowel; in other words, if gangrene has already occurred, or the bowel is in such a softened seminecrotic state as to make one certain that it would be dangerous to return it to the abdominal cavity, two courses are open to the surgeon: (1) Resection of the gangrenous portion, followed by end to end anastomosis, or closure of the proximal and distal ends with lateral anastomosis; (2) establishment of an artificial anus.

Resection is ideal, more in consonance with surgical principles, and if the condition of the patient is good, the operator of more than average skill, and he has competent assistants, it should be first considered.

If, as is frequently the case, the patient is much reduced on account of prolonged vomiting, shock, and absorption of ptomaines, so formidable a procedure as resection of the intestine and restoration of the continuity of the alimentary tract may be out of the question. In such circumstances, the safety of the patient will probably be best subserved by making an artificial anus temporarily, hoping to close it later on. There are two ways of doing this. First, cut the constriction, pull down the intestine, excise the gangrenous portion, and suture both the proximal and distal ends to the skin. Another plan is to incise the intestine so as to let the gas and feces escape *without* cutting the constricting band. In this way, soiling of the peritoneal cavity is prevented, as gas and feces readily escape externally.

Very recently, one of us did this with success in a feeble old lady nearly eighty-seven years of age, who for years had suffered from a large irreducible epiplocele. Strangulation eventuated, being superinduced by the descent and nipping of a portion of the ilium; it having lasted from Tuesday morning until Friday at 3 A.M., the time of our visit and operation, gangrene of course, was to be expected. Both omentum and bowel were gangrenous. The former was resected, a piece larger than a fist being removed. The condition and extreme age of the patient not warranting resection and reëstablishment of the continuity of the intestinal tract, an artificial anus was established by incising the gut and making free drainage. To protect the cavity against infection *the constriction was not cut.* All symptoms of strangulation were at once relieved, there being no further vomiting or pain.

Inasmuch as it is impossible to say whether or not the gangrene has extended beyond its apparent limits and *above* the constriction, this is necessarily surgery in the dark and, as a rule, not to be recommended.

There are many reasons why an artificial anus should not be established, except it be as a *dernier ressort.* In the first place, the thought of it is always one of repugnance to both patient and friends. Next, it presupposes the danger, discomfort, and loss of time incident to a second operation. Furthermore, if the herniated bowel be the jejunum or upper ileum—not infrequently the case—the patient must rapidly fail from malnutrition. We now appreciate the important role the upper intestine plays in digestion and that the stomach largely receives and prepares food for assimilation in the intestines below.

In spite, however, of the natural and surgical reasons for not making an artificial anus, the condition of the patient, his environment, and the want of the best surgical assistants may make it necessary. What is best for one case is certainly worse for another. Good surgical judgment must be shown, and nowhere in surgery does the personal equation count for so much.

Assuming a favorable case, one in which the bowel regains its normal condition after the constriction is relieved, herniotomy should always, when practicable, be supplemented by a radical cure. It is only a question of ten minutes longer under the anesthetic, and it eliminates all further dangers from the hernia. It should be carried out according to one of the approved methods, Bassini's being preferred.

The after-treatment of patients who have had strangulation is of the greatest importance. Vomiting has been so persistent that the thirst of such patients is well-nigh unquenchable. Therefore, water should be given in moderation as soon as the patient comes out of the anesthetic. Before he has done so, continuous enteroclysis should be begun. Not only is thirst relieved in this way, but the kidneys and skin are made more active, thereby eliminating poisonous products which have been absorbed. A little highly concentrated broth, albumin water, or milk may be given by the stomach as soon as they are likely to be retained.

The bowels should be allowed to act spontaneously, which they will usually do within twenty-four hours. Should such be not the case, an enema may be given. Purgatives by the mouth are dangerous, and should not be given, lest by their drastic action they cause damage to, or even perforation of, the bowel.

In the somewhat rare form of Richter's hernia, we think, on the whole, that an artificial anus would generally be indicated, for the symptoms of strangulation are not so severe, and, therefore, such cases will have lasted several days in all probability before they come to operation. Hence they will not be in a condition for resection with a restoration of the continuity of the alimentary canal, and an artificial anus is both easily and quickly established. It is, moreover, likely to be followed by spontaneous closure unless the knuckle of gangrenous intestine is large.

Having considered the treatment of irreducible, obstructed, inflamed, and strangulated herniæ, we will now state frankly our views concerning the treatment of the most common variety—reducible hernia.

The treatment is either mechanical or operative. While not denying the advantages and indications for mechanical, or truss, treatment, in well-selected cases, we wish to state most positively our belief that it is the treatment for the *exceptional*, not the average case. In other words, it is our opinion that mechanical treatment should only be used when there is some good contra-indication to operation. We say this for two reasons: (1) On account of the uncertainty and the potential dangers of truss treatment; (2) because the operative treatment is practically free from danger and almost invariably successful. We believe that during the last decade there has been a very decided change in professional sentiment concerning the value of mechanical treatment, and that trusses are being used very much less frequently than during the time when the radical cure operation was less satisfactory than it is at present.

Young infants, and very old people, especially those with bronchitis, arteriosclerosis, disease of the kidney, diabetes, etc., should usually be treated by mechanical rather than operative means. All others should, as a rule, be promptly submitted to operation. It seems utterly incongruous at the present time to advise a young adult, a middle aged man or woman, or even one in the youth of old age, to wear a truss rather than to submit to an operation having a mortality so small as to be negligible, and results almost invariably satisfactory.

Even those who fear a general anesthetic can be operated upon, cocaine or other local anesthetic being used.

Our operations in young children have been uniformly successful, and we do not hesitate to advise a radical cure after two years of age, and oftentimes, and for good reasons, sooner. Few mothers have the time, the intelligence, and the patience to get the best results from mechanical treatment. If such treatment is to be carried out imperfectly, it is worse than none at all. We have not found any more difficulty in securing primary union after operations in childhood than we have in adult life.

Believing, therefore, that too much attention is still given mechanical treatment, we shall say nothing concerning the different varieties of trusses, their applications, etc.

Operative Treatment. Interesting as it would be to begin with the first operation for the radical cure of hernia, following it by all of the various steps and advances which have been made in the evolution of the perfected operation of today, we hardly think it would subserve any useful purpose at this time. Many errors were made by those introducing new methods, largely on account of faulty anatomical conclusions. While not inclined to discredit

the efforts of earlier workers in this line, it must in all candor be said that no great advance was made until the introduction of the operation of Bassini in 1889.

The principal features of this method contemplate separation of the cord in the male, the round ligament in the female, from the sac; high ligation of the sac; removal of the sac; suture of the conjoined tendon or internal oblique and transversalis muscles above to the deep shelving of Poupart's ligament below, by which a new floor is made for the canal; transplantation of the cord, and suture of the external oblique muscle *over* the transplanted cord.

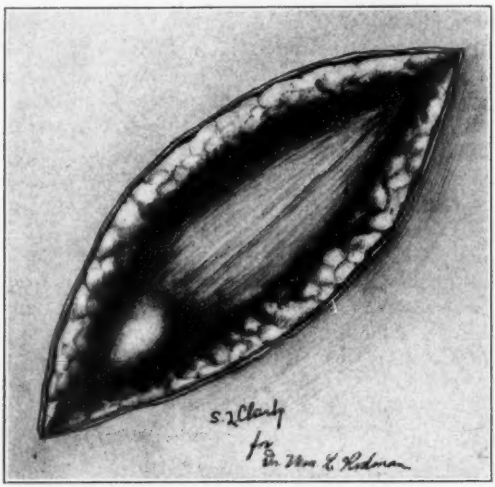

FIG. 1.—Showing the hernia presenting at the external abdominal ring after the skin and fascia have been divided and the aponeurosis of the external oblique muscle exposed. (Drawing made from sketches taken at Dr. Rodman's clinic, Medico-Chirurgical Hospital.)

In short, the inguinal canal is reconstructed (Figs. 1, 2, 3, 4, and 5.) Some of the above steps had been adopted by various operators, but with indifferent success. All, or nearly all, of them are essential.

There are some excellent surgeons who still retain the sac, but nearly all who do have a different method of disposing of it. It seems to us that it should always be removed, and that its retention, whatever may be done with it, constitutes a distinct menace.

The principles which Bassini advocated and caused to be accepted throughout the civilized world had been, it is true, followed and advocated in the main by Marcy, and perhaps others. While the very best results have been and are being obtained by Bassini's operation, there is undeniably a growing tendency among many operators not to transplant the cord in every case (Fig. 6).

FIG. 2.—The inguinal canal is about to be opened by an incision made in the groove of a director which has been passed through the external abdominal ring. The structure to be divided is the aponeurosis of the external oblique muscle. (Drawing made from a sketch taken at Dr. Rodman's clinic, Medico-Chirurgical Hospital.)

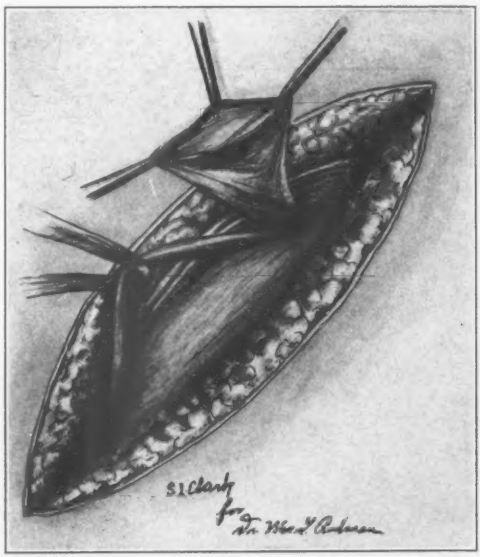

FIG. 3.—The sac of the hernia has been opened, the contents reduced, and the sac separated from the spermatic cord. (Drawing made from sketches taken at Dr. Rodman's clinic, Medico-Chirurgical Hospital.)

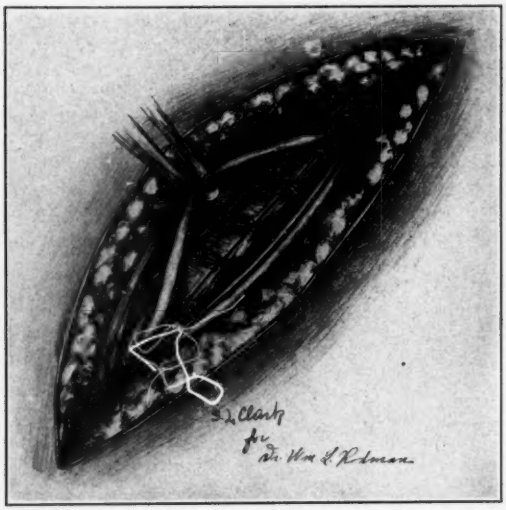

FIG. 4.—Showing Bassini's method of radical cure. The lower margin of the internal oblique muscle, together with some of the transversalis, has been sutured to the shelving margin of Poupart's ligament. The spermatic cord will be placed upon the new floor thus formed. (Drawing made from sketches taken at Dr. Rodman's clinic, Medico-Chirurgical Hospital.)

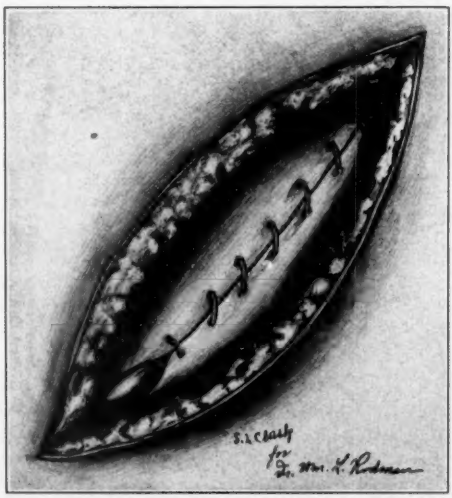

FIG. 5.—Showing the aponeurosis of the external oblique muscle sutured over the spermatic cord. (Drawing made from a sketch taken at Dr. Rodman's clinic, Medico-Chirurgical Hospital.)

It is our belief that transplantation of the cord has been followed by such uniformly good results that it remains to be shown that it is *unnecessary*.

During the last five years we have in many instances omitted this step of the operation, and, so far as we know, without recurrence of a single hernia. At the same time, we have operated on a very much larger number of cases in which the cord *was* transplanted with the most gratifying results. Clearly, the cord should *not* be transplanted when the hernia is accompanied by a retained testis, inasmuch as the cord is already too short.

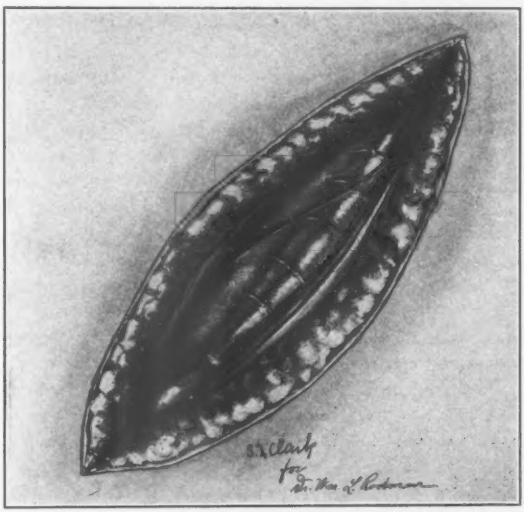

FIG. 6.—Showing the internal oblique and transversalis sutured to the shelving margin of Poupart's ligament without transplantation of the spermatic cord. (Drawing made from sketches taken at Dr. Rodman's clinic, Medico-Chirurgical Hospital.)

The frequent association of oblique inguinal hernia and retained testis is well known. Usually it is quite easy to bring down the testis (especially if the method of Bevan be employed), and to transplant it into the scrotum. The former practice of sacrificing the organ is rarely justifiable now, as it is surprising how these very small, seemingly imperfect, testes develop and thrive when brought down into the scrotum where they are relieved from pressure and constant irritation. We have operated on a number of these cases with the utmost satisfaction. The operation of Bevan is much the best.

Only a few weeks ago it was the privilege of one of us to reexamine a boy of seventeen years upon whom he had operated for retained testis eight years previously. At the present time the

transplanted organ is quite as large as its fellow. At the time of the operation, when he was nine years old, the testis was ill-developed and situated high up in the inguinal canal. In truth, it was so small and the cord so short, that the father of the boy, himself a physician, doubted the wisdom of the attempt to save the organ, and would have been better pleased had castration been performed. He continued to be pessimistic as to the outcome, and would so express himself at our meetings for several years subsequent to the operation. He now informs us that with the onset of puberty the testis began to enlarge, became firmer to the touch, and showed decided evidence of awakening. It is needless to say that he is delighted with the result.

One of us has had other cases quite as satisfactory since beginning to operate upon these patients more than twenty years ago. We think it necessary, and invariably do so, to follow such transplantation by a radical cure for hernia. The two conditions are frequently, if not usually, associated. Further, the patients in whom hernia has not developed are certainly more than ordinarily predisposed to it on account of the long dilatation of rings and canal by the misplaced testis.

It is our belief that too much has been written concerning the liability of retained testes to undergo sarcomatous change, and for this reason demanding castration. Twenty years ago one of us was of this opinion, having seen one such case, and being influenced by the literature of that day; hence he advised removal of one or two retained testes, believing that they were without function and a perpetual menace to life itself. We have advised and practised transplantation, however, in every case presenting itself during the past fifteen years.

More important than the question of transplantation of the cord are the ones of securing primary union and the use of absorbable sutures. In order to secure asepsis, we believe it almost indispensably necessary for operator and assistants to wear rubber gloves. Hemorrhage should be carefully arrested, lest a hematoma form and thus further the liability to infection.

If the veins of the cord are enlarged, we do not hesitate to resect them, and have done so in a fairly large number of cases. In a few instances a hydrocele has developed after this procedure, but we have never witnessed what others have seen, namely, atrophy of the testicle.

In addition to the principles embodied in the Bassini procedure, we employ in all direct, and in many indirect herniæ, transplantation of the anterior sheath of the rectus muscle, and believe it to be a most useful step (Fig. 7). Transplantation of the substance of the rectus muscle is not employed as a routine procedure. In operating upon a large congenital hernia in an adult whose inguinal canal was greatly widened, one of us recently turned

down a portion of the muscle, together with its anterior sheath, in the manner shown in Fig. 8, and then sutured the superficial

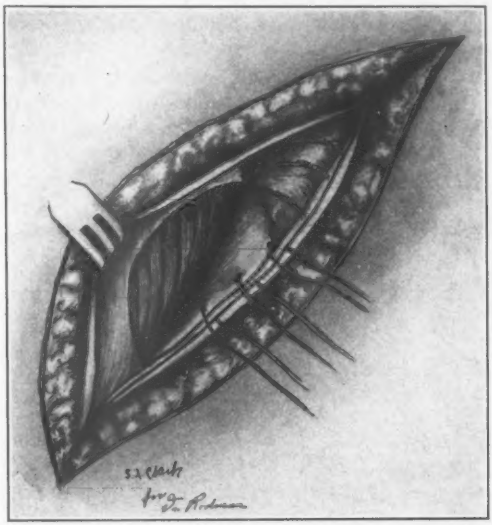

FIG. 7.—Transplantation of the sheath of the rectus muscle. (Drawing made from a sketch taken at Dr. Rodman's clinic, Medico-Chirurgical Hospital.)

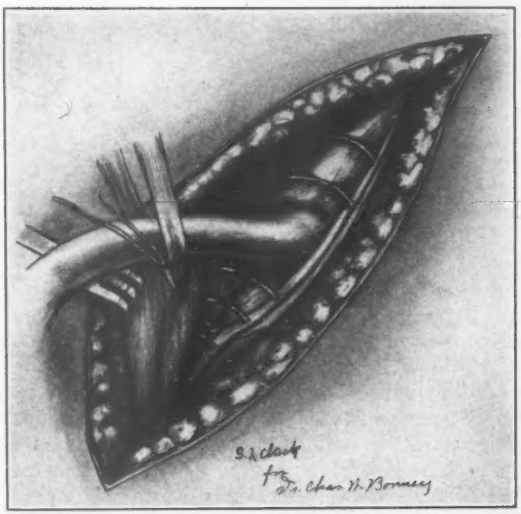

FIG. 8.—Showing a method of transplanting a portion of the rectus muscle as well as its sheath. (Drawing made from a sketch taken during an operation by Dr. Bonney.)

fascia to the cut margin of the rectus. It was hoped that this procedure would lend additional strength to the reconstructed canal even though the transplanted muscle atrophied.

In congenital hernia a tunica vaginalis testis may be formed in the manner shown in Fig. 9.

If the muscles are very much attenuated or stretched, overlapping, or the so-called imbrication in the manner indicated in Fig. 10, is practised. We believe this step one of the decided

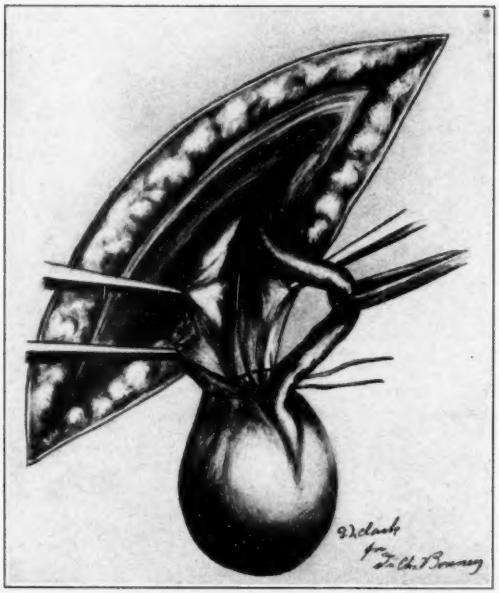

FIG. 9.—Showing a method of making a tunica vaginalis in cases of congenital scrotal herniæ. (Drawing made from a sketch taken during an operation by Dr. Bonney.)

advances made in recent years. First introduced by Andrews, of Chicago, it has been variously modified by many operators.

We also preserve and make use of the cremaster muscle. In two direct and one indirect herniæ which recurred after the ordinary Bassini procedure, with transplantation of the cord, we re-operated successfully by transplantation of the sheath of the rectus. These and two others are the only five recurrences, so far as we know, in more than eight hundred operations for inguinal hernia. That other patients have suffered recurrences we do not doubt, but they have not reported themselves to us. We are reasonably sure, however, that no recurrence has taken place in any of our private

patients, all of whom have been followed and traced. No attempt has been made to follow up ward cases operated in the several hospitals with which we are connected.

There has been no mortality from the operation. One case was lost after an operation for a large umbilical hernia in a stout woman who weighed two hundred and fifty pounds. Death occurred at the end of three weeks when the patient was about ready to leave for her home. She died one morning about three o'clock after an illness of a few moments. Death was evidently due to embolism. Many such cases have been reported, as embolism seems to be somewhat more closely associated with hernia than would appear reasonable.

FIG. 10.—Showing overlapping of the aponeurosis of the external oblique muscle from above downward. The upper sutures are inserted from without inward. (Drawing made from sketches taken at Dr. Rodman's clinic, Medico-Chirurgical Hospital.)

Formerly, for instance, fifteen years ago, we believed it necessary to keep patients in bed four weeks, but an increasing confidence in the operation has caused us to shorten the interval until now we think a fortnight in bed long enough. We never advise that a truss or elastic belt be worn. We do, however, insist that a rather firm spica bandage, made of flannel, applied over a compress of gauze, be worn for several weeks after the patient gets out of bed. Such support not only secures the comfort of the patient, but we

believe is a safeguard against recurrence. Wound healing does not take place with the same rapidity and certainty in all cases. Therefore, it seems to us that this precaution should be taken.

Double Hernia. Not infrequently patients present themselves with a hernia on both sides, and it becomes a question as to whether one or both sides shall be operated on. As the duration of the operation for radical cure does not, as a rule, consume more than ten or fifteen minutes, there is no reason why both sides should not be operated at the same time. It is our invariable custom to follow this plan, and in addition not infrequently perform an appendectomy, circumcision, or radical cure for varicocele, should such operation be necessary. Little is added to the danger of the operation either from the anesthetic or shock if the procedure is completed within an hour.

In cases in which a general anesthetic seemed contra-indicated, we have also operated with entire satisfaction under spinal anesthesia or cocaine used locally. We do not believe with some, however, that this operation should usually be done under local anesthesia, as the time is prolonged and the dangers of wound infection proportionately increased.

One of us has operated under spinal anesthesia in quite a number of cases with perfect satisfaction, and do not hesitate to make use of it when there are contra-indications to general anesthesia. There are times when we have found it very convenient to have the cooperation of the patient and to have him cough or strain at the desirable moment. For the same reason we often employ spinal analgesia in operations on the rectum, and find it most helpful. One of us has performed a radical cure for hernia and then sutured both external and internal sphincters of the rectum (which were cut by a farmer's falling astride a pitchfork) under one injection of stovaine. Notwithstanding the fact that more than an hour was necessary to do the hernia operation and then carefully to suture first the internal and then the external sphincters, the entire operation was painless. Had it not been for the coöperation of the patient, it would not have been possible to suture the internal sphincter muscle so well. Incontinence of feces, which was complete before operation, was entirely and at once relieved.

THE DIAGNOSIS OF CANCER OF THE INTESTINES.[1]

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In considering the cause of any chronic digestive disorder, cancer can never be left entirely out of account. It is always a possibility in any patient over thirty years of age; always the most likely explanation in any patient over forty; and never can be eliminated from the calculation until after all the evidence has been obtained and carefully weighed. But cancer is not equally distributed throughout the digestive tract. In fact, it exhibits a decided partiality for some regions and a decided neglect for others, so that a knowledge of this peculiarity aids us if we can trace the origin of the symptoms to a certain organ or a certain region in the abdominal cavity. With stomach symptoms predominant, cancer is particularly to be borne in mind in any chronic case, for the great frequency of cancer of the stomach can never be forgotten. But with intestinal symptoms the striking ones, cancer is less prominent in the diagnostic possibilities, because the intestinal tract is so much less frequently the site of malignant disease. Furthermore, in the long distance between the pylorus and the anus certain parts are much more susceptible than others to cancer, so that within the intestinal tract the part to which the symptoms point again helps us to determine the probability that cancer exists. About this probability of cancer in different parts of the intestine, as well as about the evidence that speaks for the disease in each part, one must think very carefully if an early accurate diagnosis is to be made, for only early diagnosis makes surgical cure a probability.

A. Cancer of the Duodenum. This is a very rare site for malignant disease. Nevertheless, the symptoms produced when the disease does occur are so striking that the interpretation ought to be easy. Like cancer elsewhere in the body, the growth here produces such general manifestations as anemia and cachexia, pain and often a palpable tumor; the pain and tumor are usually located in the upper right quadrant of the abdomen, more accurately in the right hypochondrium and epigastrium. In addition, certain special symptoms arise, according to the part of the duodenum involved. Boas classifies duodenal growths with reference to the biliary papilla into three varieties: (1) Suprapapillary, (2) circumpapillary (3) infrapapillary.

1. In *suprapapillary* cancer, no localizing symptoms arise until stenosis of the bowel results. As soon as stenosis occurs, the symp-

[1] Read at a meeting of the Nevada State Medical Society, at Goldfield, Nevada, October 5, 1909.

toms and signs become those of stenosis of the pylorus, with dilated stomach, and it is usually impossible to decide clinically whether the cancer originated at the pylorus or below it. In such a case—with general symptoms of cancer, such as anemia, cachexia, and loss of weight; with localizing symptoms, such as pain and a palpable tumor in the right hypochondrium; with special symptoms, such as food retention and repeated vomiting of stagnating contents; and the physical signs of dilated stomach, such as tumor, peristaltic wave, succussion splash and the proof of food retention by the stomach tube—a diagnosis of cancer at the pylorus would almost certainly be made, and in most instances it would be correct, because of the much greater frequency of cancer there than in the supra-papillary portion of the duodenum.

2. *Circumpapillary* cancer furnishes a new and prominent symptom—jaundice; with anemia, cachexia, and loss of weight as before; tumor in the right hypochondrium; but less pain as a rule and less of the former gastric manifestations. Jaundice is progressive and ultimately profound; and the symptoms characteristic of this condition become the predominant ones. Differentiation from malignant disease originating in the common duct, or in the head of the pancreas, or in the lower portion of the liver, would in such a case be practically impossible. Minute points of difference can be cited, but speaking from the view-point of these other conditions, the distinguishing marks are of little real value.

3. *Infrapapillary* cancer introduces still other characteristic symptoms and signs into the clinical picture. Stenosis of the duodenum below the papilla leads to stasis of the bile and pancreatic juice, their regurgitation into the stomach and their rejection from the body by vomiting. There is a large epigastric distention due to dilatation not only of the stomach but of the duodenum above the point of obstruction; copious vomiting of dark brown material resembling bile, neutral or alkaline in reaction and responding to chemical tests for bile; the presence in the fasting stomach in the morning of quantities of this same fluid, even though the organ has been carefully washed out the night before; and stools that are white and lacking in bile. This combination of symptoms and signs corresponds to no other condition exactly, though it resembles most closely acute dilatation of the stomach, and at first may be mistaken for it. The persistence of the symptoms; the development of a tumor in the epigastrium; the absence of bile from the stools; and the occurrence of increasing cachexia and malnutrition should serve to identify the case as one of duodenal cancer.

After all, two facts afford us consolation when we consider the difficulties and uncertainties of diagnosis in duodenal cancer; (1) that cancer in this part of the bowel is extremely rare; and (2) that all the conditions resembling it closely and causing the confusion in decision, demand operation for relief, and no fatal mistake can be made by advising surgical intervention when in doubt.

B. Cancer of the Jejunum and Ileum. According to all observers, cancer is rare in the ileum and still more rare in the jejunum. The whole of the small intestine seems singularly exempt from attack, as compared with the stomach above and the colon and rectum below. It is fortunate that this is so, for the jejunum and ileum particularly are difficult of investigation and their ailments hidden from observation. Cancer in this part of the bowel, as elsewhere, causes anemia, cachexia, and malnutrition; with localizing symptoms, such as attacks of colic, alternating constipation, and diarrhœa, sometimes hemorrhages, but nothing to point to the small intestine rather than the large as the site of the disease. Even when a tumor is palpable, as it most often is not, we have no positive way of determining its site. But in such a discouraging condition of affairs it again is a comfort to reflect that cancer in the small intestine, at least below the duodenum, is almost never found, not only by the clinician, but also by the surgeon and the pathologist.

C. Cancer of the Colon. Beyond the ileocecal valve the incidence of cancer rapidly increases, and we come into the presence of a lesion fairly common. To prove that this is not merely an individual experience, the statistics collected by Brill[2] are convincing, for he found that out of 3,563 cases of intestinal cancer reported by various observers, only 89, or 2.5 per cent., were in the small intestine. Nothnagel[3] records that out of 343 cases of carcinoma of the intestine discovered during twenty-four years among the autopsy material of the Pathological Institute of the General Hospital in Vienna, only 17 were in the small intestine—less than 5 per cent. In the investigation of any case suspected to be intestinal cancer, we start, therefore, with the probabilities all against a growth above the ileocecal valve. As with all diagnosis, our data here are obtained from two sources—subjective and objective evidence—the patient's story and our own observations.

I. The Subjective Evidence. The clinical history of cancer of the colon is based largely upon increasing obstruction of the bowel caused by the growth; and the symptoms are mainly those of stenosis. The three complaints most often heard are of increasing constipation, flatulent distention, and recurring attacks of colic. Each of these is of great importance, but none alone is sufficient to cause more than suspicion; while even the coincidence of all three does not afford certainty without the other data furnished by various methods of examination.

1. *Increasing Constipation.* This is usually the first symptom to attract the patient's attention. Previously regular about daily defecation, he gradually comes to require the aid of laxatives; these gradually fail to act; the constipation grows more and more

[2] Amer. Jour. Med. Sci., 1904, cxxviii, 824.

[3] Diseases of the Intestines and Peritoneum, Nothnagel's Encyclopedia, p. 413.

obstinate; the patient finds the greatest difficulty about getting the bowels to move at all; and at last there occurs complete occlusion. The following case illustrates this very common history:

CASE I.—A man, aged fifty-six years, was seen in June, 1907. His chief complaint was obstinate constipation. This had begun five or six years before, gradually increased in severity, and had been worse for the last year than ever. For six months he did not have a voluntary passage, and had taken all sorts and kinds of physic in increasing doses, more and more being required to produce any effect. Recently he had become "run down," weak, easily tired by exertion, and had lost ten pounds in weight. He had no pain until the last month before he sought advice, but during that time recurring attacks of what he called "the gripes." Over the left side of the abdomen, in the course of the descending colon, there were found numerous discrete lumps, movable and not tender, evidently retained feces. No other tumor was palpable. Operation revealed a malignant growth involving the sigmoid flexure and descending colon, hard and firmly adherent, too extensive for removal. The patient died a few months later.

2. *Flatulent Distention.* This by itself is by no means a sign of cancer of the colon. In fact, it more often means something else. When persistent, it almost invariably means the retention of fecal masses in the colon, and disappears most certainly after a brisk purge. The danger is that the diagnosis will not go beyond this fecal retention, and that the cause of it will be overlooked, particularly if chronic constipation is associated, this apparently explaining both the fecal accumulation and the flatulent distention. The following case shows how flatulence may be practically the only symptom and how cancer of the colon may for months give little other sign of its presence.

CASE II.—A man, aged sixty-two years, first consulted me in December, 1906, complaining that he awakened every morning early with a feeling of distention and tightness in his abdomen. This so annoyed him that he always had to rise and stir about; but as soon as his bowels moved, and gas was passed freely, he had no further trouble during the day. This difficulty had been going on every morning for months. Otherwise he felt well, and had no complaint to make. He was a very large, rather corpulent man, florid and apparently in perfect health. There had been no loss of weight. The abdominal examination, repeatedly made, was always negative as regards tumor or tenderness, but the bowels were always found distended with gas. They moved regularly every day, and various laxatives advised only caused diarrhœa and cramps, but did not prevent the flatulent distention. Finally, in April, 1907, after taking castor oil one evening, violent pains were set up, and continued all night. The next morning the abdomen was found greatly distended, rigid, and tender; the pulse rapidly grew irregular and weak, and in a few hours the patient died. Autopsy showed a rent in the ascending

colon near the hepatic flexure, with escape of a large quantity of feces into the peritoneal cavity, and a nodular carcinomatous constriction, annular, hard, and practically occluding the lumen, just beyond the rent.

3. *Recurring Attacks of Colic.* These do not always occur. When they do, they are usually associated with alternating constipation and diarrhœa. The bowels for a time are very obstinate and refuse to respond to laxatives; then comes a sharp attack of colic, with diarrhœa and profuse discharges. This is followed by another period of constipation, terminating sooner or later in colic and diarrhœa. In the interval between attacks there is usually no pain at all. Such a history does not necessarily mean cancer of the colon, but it does mean stenosis of the large bowel, fecal accumulation, increased peristalsis due to mechanical irritation, and emptying of the retained contents. Ultimately the time arrives when the stenosis cannot be overcome by these more violent waves of colicky peristalsis, and complete intestinal obstruction occurs, and possibly rupture of the bowel, as in the case last reported.

4. Finally, certain symptoms expected in the clinical history of cancer elsewhere must not be looked for in cancer of the colon until very late, and their absence must not mislead. There is usually no loss of weight in consequence, and nutrition is but little disturbed. The patient does not complain of weakness or exhaustion. There may be no noticeable anemia or cachexia, and the appearance continues to be that of health. Pain is usually absent, except during the attacks of colic. In fact, before the development of marked mechanical interference with the lumen of the bowel, cancer of the colon gives little sign of its presence, and it is not until late in its history, when metastases to other organs have already occurred, and operative interference is practically useless, that the disease is usually discovered.

II. The Objective Evidence. This includes all that can be found out about cancer of the colon by various methods of examination. These methods comprise physical examination of the abdomen, examination with the x-rays, and examination of the feces and of the blood.

1. *Physical Examination of the Abdomen.* The whole object of this is to discover whether or not a tumor is palpable, and if it is found, to ascertain whether it is really a growth arising from the colon. (*a*) When no tumor is found, the diagnosis of cancer of the colon nevertheless cannot be set aside, for the annular carcinoma, encircling the bowel with a ring of hard, sclerotic tissue, may be absolutely incapable of detection by palpation through the abdominal wall, particularly if the wall is thick with fat or if the intestines are constantly distended by gas, as in Case II. Or, the tumor may be so situated that it is inaccessible for palpation, as beneath the liver or other intestinal coils. But repeated attempts should be made to

discover a tumor, before a decision is reached that it does not exist, and under special conditions, as well as under ordinary ones—for instance, after free purgation with castor oil and fasting for twenty-four hours, or in a hot bath to relax the abdominal walls, or under anesthesia. (*b*) When a tumor is found, there are no characteristics that positively identify it as connected with the colon. In size, it may be very small or very large. In consistence, it is usually very hard and cartilaginous, but so are cancerous growths within the abdomen arising from other organs. In form, it may be irregular and nodular, or rounded and smooth. In sensitiveness, it is usually tender to pressure, and may be extremely so; but, on the other hand, it may be handled without causing any pain at all. In mobility, it usually can be freely carried about within the abdomen by the examining hand; but if adhesions have formed, fastening the tumor to some adjacent organ or to the abdominal wall, it becomes quite fixed, and immobility of a tumor, therefore, does not negative the diagnosis of cancer of the colon. As regards position, it may be found in any part of the abdomen.

In the absence of any distinguishing characteristic on palpation, to assure the diagnosis of cancer of the colon, other means of physical examination must be employed for identification and other possibilities must be eliminated. The colon should be inflated with air, to determine the relation of the tumor to the bowel. Castor oil and high enemas should be employed to prove that the tumor is not fecal. The stomach should be inflated, and a test meal given to learn whether the tumor is possibly gastric. The kidneys should be catheterized if the slightest doubt exists as to whether the tumor is renal. A blood count will help to prove that the tumor is not splenic. Percussion and palpation with the patient in different positions will usually show when the tumor is hepatic—such as a Riedel's lobe. Finally, the employment of the other methods of diagnosis, presently to be described for cancer of the colon, will greatly aid in the identification.

As an instance, however, of the possibilities for error when a tumor is found, the following case is significant:

Case III.—A woman, aged forty-five years, was seen in consultation in October, 1900, on account of dragging pain in the right side of the abdomen and back; she had lost slightly in weight, was constipated, and had symptoms of dyspepsia. In the right upper abdomen a tumor was found, corresponding in size, shape, and location to a prolapsed kidney. She was examined during her illness by seven different physicians and surgeons, who all agreed that she had a prolapsed kidney, the only question being whether the kidney was likewise diseased. It was finally decided that the organ was tuberculous, mainly on the testimony of a pathologist who claimed to have found tubercle bacilli in the urine, and that, therefore, the kidney should be removed. At the operation it was found that the

tumor was a cancer of the ascending colon, and that the kidney was in normal position and perfectly sound. The growth was removed, but the patient died a few months later from recurrence.

2. *Examination by the X-rays.* When this method of diagnosis has been desired, I have always referred my cases to someone expert in its use, for the making of the plates and for the interpretation of their meaning. I have, therefore, asked my associate, Dr. Charles M. Cooper, who has charge of the *x*-ray department at Lane Hospital, and whose experience is very large, to outline the method and its value in cancer of the colon. He writes as follows: "In the early diagnosis of cancer of the colon the *x*-rays are of little or no assistance. It is only after obstructive symptoms have developed that we can hope to show the delay point in the passage of the bismuth meal. Even then the interpretation is subject to fallacies, and must only be given special significance when in agreement with the clinical deductions. The demonstration of the nature of the obstructive agent presents still more difficulties. It is probable, however, that a comparison of radiograms of the bismuth-containing colon and of the air-filled colon will be of assistance in the field of diagnosis. Regarding the methods employed, there are three: (*a*) A bismuth test meal is administered by the mouth. This may consist of boiled rice, potato puree, barley broth, or minced meat, according to the desires of the patient. The amount for an adult is 400 grams by weight. One or two ounces of bismuth subcarbonate or oxychloride are rubbed up into a thin paste, with water or milk, and the food added little by little to the bismuth suspension, with which it is well mixed. The meal should be served warm. Normally, within six hours this has filled the cecum and the ascending colon. The whole colon is gradually filled, and twenty-four hours after the meal is taken the radiogram is made. (*b*) The bismuth may be given through the anus. Castor oil is administered the evening before and a cleansing enema the next morning. Then an enema is slowly introduced, consisting of a pint of mucilage of acacia to which one or two ounces of bismuth subcarbonate or oxychloride has been added. The tube should be of big bore, and it is only necessary to introduce it just past the anal canal. The bag containing the enema should not be more than one foot above the level of the buttocks. The patient rests on the back for forty-five minutes, and then the radiogram is made. (*c*) Examination may be made without the bismuth. If the bowels have been thoroughly evacuated, and the colon be partially distended with air through the rectum, radiograms can be obtained which outline very distinctly the ascending and descending colon. The sacculations and the separating folds may be very clear. The transverse colon does not lend itself so well to this method of investigation. Interpreting the plates obtained by any method, the points to be studied are: the extent of colon occupied by the bismuth mixture; the position of the colon; the uniformity of the

bismuth shadow; and the relationship of the colon to the other intra-abdominal organs."

3. *Examination of the Feces.* This no longer means simply an inspection of the bowel discharges, with reference to possible peculiarity in contour, such as flattened, ribbon-shaped, or pencil-shaped stools. These are significant of stenosis if they are found, but the stools may be normal in appearance, even with a large growth. Of more importance is the examination for mucus, pus, and blood. *Mucus* by itself is of little importance, for it is found in a great variety of intestinal conditions. *Pus* is of much more significance, but cannot be expected unless ulceration of the tumor has taken place. Even so, its presence means only ulceration of some kind, not necessarily cancerous; while its absence by no means negatives the diagnosis, for the growth may not have broken down. *Blood* may be found when no ulceration has occurred, from oozing or from traumatism by hardened feces, but it may be absent throughout the whole course of the disease In any event, the amount is usually small and occult, mixed intimately with the feces. It is the combination of mucus, pus, and blood in the feces that is particularly significant. Persistence of this combination always means one of three things: cancer of the colon, dysenteric ulceration (especially amœbic), or an abscess that has ruptured into the bowels from some other viscus.

4. *Examination of the Blood.* The blood picture in cancer of the colon is that of a secondary anemia, with moderate leukocytosis, the differential count showing a relative increase of the polymorphonuclears. Naturally, no inference can be drawn from this evidence taken alone, but it is of value in connection with the other data, both for direct and differential diagnosis.

D. Cancer of the Rectum. Malignant newgrowth originating in the sigmoid flexure or below is one of the most insidious diseases which we ever meet, and almost, as a rule, it has advanced beyond the stage of operability before it gives rise to symptom that lead the patient to seek advice. It does not cause anemia, cachexia, or loss of weight and strength until late in its history, and its local manifestations may be altogether overlooked for a long time. These local manifestations occur in several groups: (1) Those due to bowel obstruction; (2) those due to pressure on surrounding parts; and (3) those due to ulceration of the newgrowth. The symptoms arising from bowel stenosis are very much the same as those occurring when the growth is higher in the colon, namely, increasing constipation, flatulent distention, and paroxysms of pain. These complaints may be the only ones, as they were in the following case:

Case IV.—A man, aged sixty-seven years, seen in October, 1908, complained that for three months he had been annoyed by increasing difficulty in getting his bowels to move. He had not much pain

except after cathartics were taken, but felt full of wind all the time, and bloated. His appetite was good, and he had not lost appreciably in weight. His abdomen was corpulent and its walls thick, so that palpation was difficult; but distinctly greater resistance and tenderness were found in the right lower quadrant than elsewhere. As no satisfactory evacuation of the bowels could be produced by cathartics or enemas, exploratory laparotomy was advised. This revealed a large, hard, inoperable carcinoma, filling the upper pelvis, apparently originating from the sigmoid flexure. The mass felt in the right lower quadrant, between the crest of the ilium and Poupart's ligament, was found to consist of enlarged retroperitoneal glands.

The symptoms in another case may be largely those from pressure of the growth upon surrounding parts. Pain in the region of the sacrum and the lower back, bladder irritation and tenesmus, or pain in the distribution of the sciatic nerve result. These symptoms may be added to those mentioned in the first group, and so serve to throw light upon the situation of the growth; or they may be the only ones of which complaint is made.

In still another group of cases the earliest manifestations are those due to ulceration, and in these the principal complaint is of chronic diarrhœa or bloody discharges, or both. Quite a common history is one of several loose passages each morning after rising, often with tenesmus, until the rectum is empty, and then no farther trouble until the following day. These passages consist of mucopurulent material mixed with the feces. With this history there is commonly complaint of increasing weakness and pallor, possibly of pain in the lower back and of urinary disturbance. Finally, the symptom that first alarms the patient may be the passage of bright red blood. Even then the condition is only too often assumed to be nothing but piles, until discovery of the true state of affairs comes too late. The following case shows what sort of history may be expected from this group:

Case V.—A woman, aged seventy-five years, seen in September, 1907, stated that about five years previously she began to notice clots of blood in her bowel movements, and at times bright red blood. This had continued at intervals ever since. At the time she sought advice she was passing bright red blood every day; in fact, it came then even without bowel movements, and she had to wear a cloth all the time, even at night, because pus and blood ran constantly from the bowel. Besides this she had pain in the rectum now and then, but not constantly; a sense of pressure and fulness there most of the time, and particularly when at stool. The bowels were obstinately constipated, and when she took physic for relief, she had many passages, with great tenesmus and suffering. She had lost about fifty pounds in weight within the last two years. Rectal examination showed an irregular, hard growth about the size of a

turkey's egg, situated about three inches above the anus, with soft, necrotic edges around the lumen of the bowel. Operation was advised, but declined. Six months later I saw her again in consultation, when a large tumor mass almost completely filled the pelvis. She died soon afterward.

One of the curious facts about cancer of the colon and rectum is the early age at which it may occur. The following case is of special interest in this connection, as well as for its manifesting itself first by hemorrhage:

CASE VI.—A man, aged thirty years, seen in July, 1907, complained that for months previously he had noticed after stool that there would be a little bright red blood at the anus, but not constantly. But a few days before I saw him he had passed a large quantity of bright red blood, with some clots, and this gave relief to a pain he had previously been having in his back. Since then bleeding had persisted every day in greater or less quantity. He was a large, well-nourished man, and no abnormality whatever was found in the abdomen, except tenderness low down on the left side over the descending colon. Rectal examination showed a tumor filling up the bowel, situated mostly on the anterior wall, irregular in contour, about four inches from the anus. Operation was advised but refused. I saw him again, in consultation, in the following November. In the meantime he had been treated by a Chinese doctor until complete obstruction of the bowel occurred, then had been compelled to seek the advice of a surgeon, who did a left inguinal colostomy. At this second examination he was found to have a large tumor practically filling the entire pelvis—tender, irregular, nodular, with bloody, purulent discharge—and had become greatly emaciated and weakened. A portion of the growth removed for pathological examination was shown to be carcinoma.

As aids to diagnosis in cancer of the rectum there are all those mentioned for cancer of the colon; but there is one other available here that was not available there, namely, rectal examination. In rectal carcinoma, abdominal examination may show no abnormality whatever, until such time as a very large tumor has developed, or masses of enlarged glands present themselves, or the liver is involved by metastasis, or ascites has occurred from general peritoneal carcinosis. For a long time the most careful abdominal palpation may reveal no tumor, because it is hidden below the brim of the pelvis; but during all this time examination through the anus will at once reveal the tumor's presence. This examination should be first by digital palpation; or if this is negative, then the cylindrical rectal speculum should be used and the parts inspected, as can be done with the sigmoidoscope even as high as ten or twelve inches from the anus. The routine rectal examination in every case of chronic digestive disturbance will often save the diagnostician from grievous error as well as the patient from fatal delay, until his case is beyond

surgical aid. This suggestion of rectal examination as a regular part of the investigation, whether symptoms seem to call for it or not, is by no means a new idea; yet the procedure is constantly forgotten. A careful clinical history should always be obtained; examination of the abdomen in every part should never be omitted; *x*-ray plates after bismuth injections should be remembered in all obscure cases; the discharges from the bowel should be examined not only by gross inspection, but also chemically and by the microscope; and the complete blood count should be made by an expert. But all these means of reaching a diagnosis may fail to reveal the existence of cancer of the rectum, when simple rectal examination would have shown its presence at once.

In conclusion, I repeat the sentences with which this paper began: that in considering the cause of any chronic digestive disorder, cancer can never be left entirely out of account, and can never be eliminated from the calculation until after all the evidence has been obtained and carefully weighed. To this conviction I would add one other, that no examination for any chronic digestive disorder is complete until a rectal examination has been made.

THE ROUTINE EXAMINATION OF THE ŒSOPHAGUS.

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Until comparatively recently an analysis of the symptomatology and an examination of the œsophagus with sounds of divers make and form exhausted our means of investigating this tube. The association of the knowledge so acquired, with the postmortem findings, has led to the establishment of certain fundamental facts, an acquaintance with which is essential prior to our investigation.

From such we cull the following:

1. Difficulty of swallowing is the overwhelmingly important symptom indicative of a lesion of, or interference with, the œsophageal tube.

2. Of every 100 patients who come complaining of this symptom, from 60 to 90 suffer from malignant disease. This comprises from 5 to 6 per cent. of all carcinomas. Of persons so afflicted, over 70 per cent. are males. This raises the question whether syphilis does not play as important a role in the etiology of cancer of the œsophagus as it is now believed to play in cancer of the tongue. Of these carcinomas, 10 per cent. arise in the cervical region, 40 per cent. at the bifurcation of the trachea, 30 per cent. at the lower end, while the remaining 20 per cent. are really instances

of gastric carcinoma which have led to œsophageal symptoms. Of the 10 cases which I have seen, 5 occurred at the tracheal bifurcation, 1 in the neck, 2 at the lower end, while 2 were of gastric origin.

3. In interference with deglutition from causes outside the œsophagus, difficulty of swallowing is rarely the first or only complaint, as it not uncommonly is in diseases of the tube itself.

4. The œsophagus is relatively insensitive and therefore severe pain is infrequent in lesions confined to its walls. The acute rending pain, retrosternal, of short duration, which most individuals have experienced on gulping down too quickly too large a swallow of fluid, and which appears to be due to an acute stretching of a segment of the œsophagus, is obviated by the slow method of taking food which these patients quickly learn to practise. Head states that the œsophagus is segmentally connected mainly with the fifth dorsal segment, and that the two maxima brought out by passing a bougie are to be found (*a*) at a spot two inches from the middle line posteriorly at the level of the angle of the scapula, and (*b*) at a spot in the fifth interspace anteriorly about half an inch internal to the nipple line. Skin sensitiveness may be associated with these pains, and overflow into the neighboring dorsal and into the cervical segments may occur. It is only during exacerbations or after the passing of instruments, in my experience, that we can outline these areas and skin segments, and we may conclude that severe pain commonly implies a spread of the disease beyond the œsophageal wall.

5. The œsophagus is not provided with location nerve terminals, and consequently the patients' fixed ideas relative to the seat of the lesion are absolutely untrustworthy. The non-appreciation of this fact has led to errors of localization. Particularly apt is he, no matter where the real lesion, to insist that the delay occurs just above the jugular fossa, as he there feels a choking sensation, perhaps because near this locality the striped constrictor muscles become continuous with the non-striped muscle of the œsophageal wall.

6. Auscultation of the œsophagus as a diagnostic method gives meagre information. As Hertz points out, the factors concerned in the production of the first and second sounds have been probably misinterpreted. The whole subject will bear re-investigation, and meanwhile conclusions drawn from its findings are unreliable. The gurgling murmur clearly audible without auscultating should probably be excepted.

7. Grave organic disease of the œsophagus frequently leads to disturbed innervation of the tube. The clinician who is unaware of this source of error may mistake the complication for the real lesion, and so incorrectly diagnose both the locality and the nature of the disease. I have seen this occur.

8. The amount of dilatation that takes place above a carcino-

matous stricture is relatively small, and the regurgitation of a large quantity (above three ounces) of food from the œsophagus should suggest a cause other than carcinoma. Very little dependence, as I have repeatedly noted, can be placed upon the patient's estimation of the amount he regurgitates. This must be seen and measured. Since free hydrochloric acid is often not to be found in the stomach contents of patients afflicted with œsophageal carcinoma, its absence from the regurgitated food does not prove the latter to come from the œsophagus. The excessive mucous secretion and the unswallowed saliva frequently lead the patient to believe that he regurgitates more food than he actually does.

9. Emaciation to an extreme degree may ensue when swallowing is seriously impaired, though the lesion be non-malignant.

10. Unilateral paralysis of the vocal cord is quite a common occurrence during the course of a carcinoma of the œsophagus. This may be present in the absence of any change of voice.

11. The act of swallowing is reflexly initiated by the contact of the food with the mucous membrane of the posterior portion of the tongue and the fauces. The food is thrown back into the required position by the voluntary elevation of the fore part of the tongue and the contraction of the mylohyoid muscles. In one patient with difficulty in swallowing, whom I was asked to see, this necessary preliminary manœuvre was found to be impossible, and the bismuth capsule lay motionless in the fore part of his mouth. When the bolus has reached the back part of the tongue it is no longer under control, and the involuntary reflex stage of deglutition begins. The peristaltic wave so induced can pass over any muscular block whether caused by lesion, ligature, or section. The loss of the swallowing reflex is clinically indicative of a bilateral lesion, as either both superior laryngeal or both recurrent laryngeal nerves must be paralyzed to prevent the occurrence of deglutition.

The special importance of a full and correct history in this field of work must always be kept in mind. In some instances it is characteristic of the particular lesion from which the patient suffers. I would draw attention to two sources of error: (*a*) Since carcinomas frequently develop on the site of old lesions or in the course of other chronic diseases, such as cirrhosis of the liver, the immediate trouble may be regarded as having been of much longer duration than is actually the case, and so an unduly favorable diagnosis made. (*b*) Carcinoma of the œsophagus is an incurable disease. The patients receiving little help, visit many physicians. Some have argued with them the reasons for the different diagnostic possibilities. The patients desirous of believing that they suffer from the least serious malady will narrate to a physician whom they later see a history strangely at variance with the real facts.

The Clinical Examination. It may seem trite to emphasize the fact that a thorough clinical examination should always precede

all the special methods of investigation. Nevertheless, so frequently is this left undone in private practice, clinic, and hospital work, that it must be that in our teaching we have failed to inculcate sufficiently the value of a system in diagnostic work. Of special importance is it to emphasize this in diseases of the œsophagus, for many of the patients so afflicted first find their way into the surgical clinic, where the gullet sounds are always handier than the percussion finger or the stethoscope. With the dissemination of the knowledge of the diagnostic value of the *x*-rays and of the œsophagoscope, some patients will first visit the radiographer, whose clinical experience is commonly of a meagre character, and who, overconfident of his results, may wrongly interpret what he thinks he sees; other patients will seek the specialists in throat diseases, from whom, indeed, has come the impetus in œsophagoscopic work. They, little practised in the art of general clinical examination, will be often tempted to œsophagoscope these patients without first having them thoroughly investigated from the clinical standpoint. If this should occur, some aneurysms will be ruptured and perhaps some œsophageal walls perforated.

After the clinical examination we proceed to examine the larynx and pharynx with the laryngoscope. Any cord paralysis or laryngeal abnormality is noted. By assuming Killian's position we can look down the trachea. By carrying out the manœuver of von Eicken after cocainizing the larynx we can, without distressing the patient, examine the hypopharynx, that is, the part of the pharynx which lies below the aperture of the larynx. If nothing abnormal be evident, the patient massages his throat below this level in an upward direction, and I have seen the saliva which does not pass the stricture re-appear in the pharyngeal slit. In a certain percentage of cases a portion of the growth may be thus seen blocking the hypopharynx, and the physician will be saved the humiliation of unwittingly passing the œsophageal tube, or maybe food in the larynx. In some cases it is better to delay considering hypopharyngoscopy until after the radiographic investigation has been carried out. It may not then be necessary.

If our examination so far be negative, we watch our patient as he tries to swallow, first, a mouthful or two of fluid and later some bread. We note if the voluntary contraction of the mylohyoid muscles and the accompanying elevation of the larynx occur, and if the involuntary part of the deglutition act ensue. After the patient has swallowed as much food as he can, we note:

1. If there be any change in the shape of the neck; if by shaking the patient's throat we can produce a succussion murmur. This was readily obtained in one of the cases of œsophageal diverticulum and led to the recognition of the seat of the mischief. Or if, after giving the patient two or three bismuth capsules, they can be massaged from the lower part of the neck into the pharynx. This

was easy of accomplishment in another case of œsophageal diverticulum, and similarly led to the discovery of the diverticulum.

2. If the laryngeal picture has changed. In one patient the filled diverticulum so displaced the larynx that the cord ran from behind forward, and to the left instead of directly forward, as they did before the sac was filled.

3. If there be any change in the character of his radial pulse from that exhibited prior to his eating. In one patient whom I saw, and who had a diverticulum, the filled sac evidently compressed the big vessels, particularly during deep expiration. If the diverticulum be in the neck region, it is the carotid and jugular pulse that should be inspected.

The patient is now referred to the *x*-ray department before any bougie or metal tube is passed.

THE X-RAY EXAMINATION OF THE ŒSOPHAGUS. The normal œsophagus throws no shadow, and it is only after introducing within it some substance or object impermeable to the rays that we are able to locate their position and study their form and function. Even with this aid the shadow cast in the anteroposterior position by that portion of the œsophagus lying below the arch of the aorta is often indistinguishable from the shadows due to the vertebral column and the overlying descending thoracic aorta.

In the left posterior or right anterior positions, the dark shadows due to the vertebral column, on the one hand, and to the heart and aorta, on the other, are separated by a clearer area, which is termed the clear middle area. Through this field the normal œsophagus runs, and it is this area that we investigate. The supra-aortic portion of the œsophagus is best investigated in the anteroposterior position.

Most of the better known röntgenologists agree that fluoroscopy is the method of choice in the *x*-ray investigation of diseases of the œsophageal tube. Having followed this line of work as an aid to clinical diagnosis, rather than as a branch sufficient unto itself, while recognizing the high value in skilled hands of the screen, and especially of orthodiagraphic work, I believe:

1. That fluoroscopy is a procedure dangerous to the operator, and necessitates the expenditure of too much time to render its adoption likely for general clinical work.

2. That many clinicians are not prepared to accept reports emanating from the *x*-ray room which are not based upon shadows which can be registered on the photographic plate, and so at least be open to the inspection of the physician.

3. For teaching purposes it is necessary to register the abnormality if one desires sufficiently to impress the student with the value of this method of examination.

We proceed as follows:

1. If the previous examination leads us to suspect the presence of a supra-aortic œsophageal pouch, we ask the patient to swallow

two or three teaspoonfuls of a mixture made up of equal parts of bismuth subcarbonate or bismuth oxychloride and sugar of milk, to which sufficient water is added to give it a paste-like consistency. We then make a radiogram as of the lung apices, using the compression diaphram, the lower edge of which rests on the manubrium sterni. Fig. 1 is of such a patient in whom this procedure was adopted. The bismuth-filled pouch is very evident. It is cleanly bordered and has no funnel-shaped opening running downward from its base, this serving to distinguish it radiographically from the local dilatations which may form immediately above œsophageal strictures.

FIG. 1 is from a patient seen in consultation with Dr. Terry. The complaint was difficulty of swallowing. The clinical examination revealed a gurgling murmur on swallowing, and a succussion splash after drinking and shaking the neck. The radiogram was taken after bismuth paste had been swallowed. The diverticulum is very distinct. The marker is over the cricoid. The œsophagoscope showed an absence of ulceration or malignant change. The sac was later removed by Dr. Wallace I. Terry.

2. If we suspect the presence of a pouch lying below the level of the aortic arch, we administer bismuth paste, and then radiograph the patient in the right anterior oblique position. The pouch will show the same characteristics, but appears in the clear middle area, of which I have spoken.

3. If we suspect the presence of a spasmodic contraction of the cardia with an accompanying œsophageal dilatation, we ask the patient to drink as much as he can of a pint of koumiss with which an ounce of bismuth subcarbonate has been well mixed. The suspension is well shaken immediately prior to use. The patient is then at once radiographed in the right anterior oblique position.

FIGS. 2 and 3 are from a patient seen through the kindness of Dr. Kugeler. The original complaint was vomiting of considerable blood. The clinical findings were an alcoholic history, a large spleen, a small liver, and hemorrhoids. The diagnosis was cirrhosis of the liver. Later there was complaint of difficulty of swallowing. A clinical examination for a cause was negative The sound was arrested at the cardia. The plates are explained in the text. Œsophagoscopic examination was arranged for, but was not carried out, and later was considered inadvisable. Later, there was paralysis of the right vocal cord, coughing up of a cupful of pus, and death. The postmortem revealed carcinoma of the œsophagus, as described; a peri-œsophageal abscess which had ruptured into the bronchus and into the pericardial sac; cirrhosis of the liver.

The bismuth-containing œsophageal sac stands out very distinctly and may fill almost the whole of the clear middle area.

4. If we suspect the presence of a carcinoma of the œsophagus, we ask the patient to swallow a few teaspoonfuls of the bismuth paste and then one or two capsules each containing seven and one-half grains of bismuth subcarbonate. The patient is then radiographed in the right anterior oblique position.

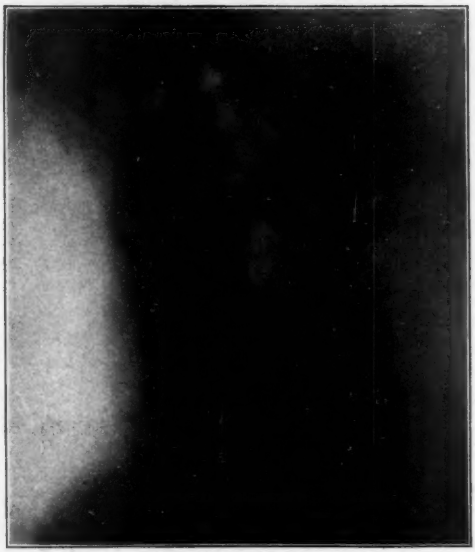

FIG. 4 is from a patient seen in consultation in whom a diagnosis of an œsophageal diverticulum had been made, being based upon a falsified history, the patient's invincible belief that the obstruction lay at the level of the jugular fossa, an occasional hindrance to the tube about this level, and a wrongly interpreted x-ray plate. The clinical examination showed great emaciation, no enlarged glands, no pupillary or laryngeal changes, no palpable stomach tumor, no systemic changes. Bismuth capsules were administered. With the fluoroscope one lost track of them in the upper part of the gullet. The bismuth, however, collected and became evident at the cardiac end of the œsophagus. The gelatin capsules evidently softened and allowed the bismuth to escape at the point where the bismuth streak begins. The œsophagoscopic examination showed a normal œsophagus. A probable diagnosis was made of spasmodic stricture of the cardia, dependent upon a malignant growth below. Operation was advised and performed. A large malignant growth infiltrating the stomach walls and situated up under the liver margin was found. Jejunostomy was done. Death occurred a week later. The postmortem revealed the œsophagus not involved in the growth

Figs. 2 and 3 are of a patient who died from a carcinoma of the œsophagus. In Fig. 2 two bismuth-containing capsules are evident. They are arrested at the upper limit of the growth. In Fig. 3 the shadow cast by the bismuth paste is seen. The œsophageal lumen is alternately dilated and constricted, but the bismuth paste shadow is continuous. Postmortem the œsophageal wall from the

level of the tracheal bifurcation to the cardiac end was found to be involved, much of the growth, however, having ulcerated away. After these radiograms were taken a peri-œsophageal abscess formed and opened into the trachea and later into the pericardial cavity.

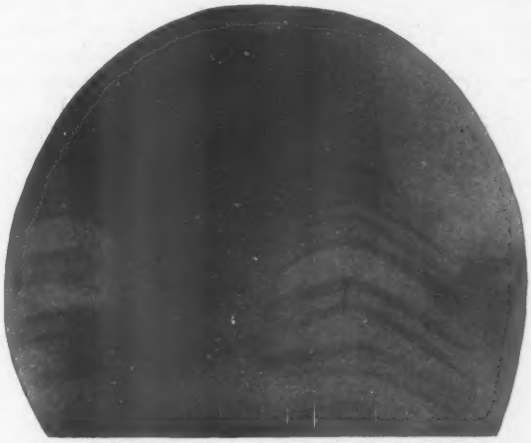

FIG. 5 is from a patient, aged sixty-five years. The complaint was shortness of breath of eight years' duration, difficulty in swallowing, and angina-like pains of a year's duration. The clinical examination gave evidence of the presence of general arteriosclerosis and of some bronchitis. A gurgling murmur was heard on swallowing. A succussion neck splash was produced after swallowing fluids. Laryngoscopy after swallowing bismuth paste showed a displacement of the vocal cords, as described. Hypopharyngoscopy was negative. The radiogram taken after swallowing bismuth paste shows the diverticulum filled with the bismuth mixture. The passage of the tubes was resisted at the cricoid, and regurgitation of food ensued. Œsophagoscopy showed a spasm of the œsophagus just below the pharyngeal slit, due to the presence of a little grayish slough, which had been probably produced by a previous œsophagoscopy (he had been previously œsophagoscoped twelve times, and no diagnosis arrived at); below that the mouth of a diverticulum, which was only evident when the sac was filled with bismuth paste; and below that in the upper thoracic portion of the œsophagus, a stricture with a curved semilunar opening situated at the side. This lower stricture is difficult of explanation, but further fluoroscopic and radiographic examination suggests that a mediastinitis involving the pericardium and the œsophagus is present in this patient. The patient is still under observation.

In other cases of carcinoma the plate shows a shadow similar to that thrown by the bismuth-filled diverticulum, but there is a funnel-shaped prolongation of the bismuth shadow through the stenosed area. Sometimes below the constriction the shadow broadens out again, there occurring a complicating spasm of the cardia, which temporarily delays the entrance into the stomach of the bismuth paste which has passed the stricture (see Fig. 6). Sometimes capsules are arrested at places past which the sound is found readily to glide, as in this case. When this occurs we suspect a paralysis of the muscular fibers of the œsophagus or perhaps their destruction, or an intermittent spasm.

5. If we suspect a narrow stricture, and wish to determine if there be a local dilatation above it, we can administer one of the capsules. This will block the opening. If the patient then swallows as much bismuth paste as he can, a radiogram will show the extent of the dilatation.

6. If the history and previous examination has rather suggested an extra-œsophageal cause for the difficulty of swallowing, or has led to no tentative diagnosis, we make two radiograms after the patient has taken the bismuth capsule and bismuth paste, one in the

FIG. 6 is from a patient aged fifty years. The complaint was difficulty in swallowing, of three months' duration. The clinical examination showed as positive findings a fœtid odor to the breath, a dilated right pupil, an old right corneal scar, a secondary anemia, and a very slow method of eating; later, spitting up of blood. Laryngoscopic examination, etc., was negative. Bismuth paste and bismuth capsules were administered and a radiogram made. The print has been described in the text. The passing of sounds and œsophagoscope was deemed inadvisable until the former should be therapeutically required. A diagnosis of carcinoma of the œsophagus at the level of the tracheal bifurcation was made.

(NOTE.—If only bismuth paste were administered, and no spasm of the lower end of the œsophagus were present, a radiogram might give no evidence of the stricture.)

anteroposterior direction during suspended respiration, the plate to include the region of the neck; the other radiogram is made in the right anterior oblique position. One or both of these plates will show the seat of delay and give valuable information regarding the nature of the underlying lesion. If an aneurysm or mediastinal tumor be evidently present, they will show whether its position corresponds to the point at which the bismuth is delayed.

The further investigation, if any, depends upon the tentative conclusion that is formed after the association of the clinical and radiographic data:

1. If we conclude that an aneurysm is present, no further investigation is required or indeed justifiable.

2. If an aneurysm be present, but the location of the stricture be below the aneurysmal sac, no further investigation is justifiable, as the sac of the aneurysm might be ruptured.

3. If we are convinced that a carcinoma of the œsophagus is present, the less the instrumental meddling the better for the patient. The passage of instruments is only called for when their use is demanded for therapeutic purposes.

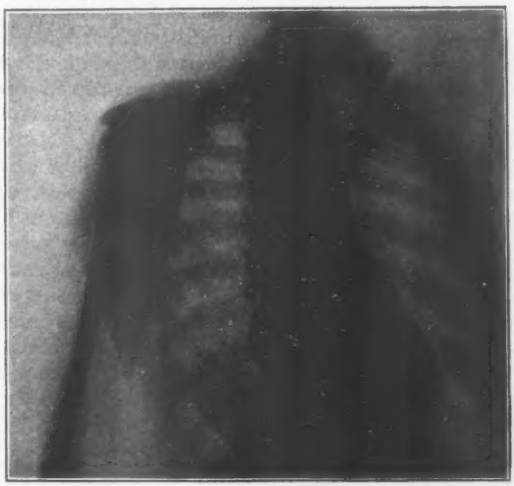

FIG. 7.—A capsule is seen lying behind the shadow due to the arch of the aorta. Bismuth paste and a large-bore stomach tube were passed without difficulty. A temporary retention of a capsule in this portion is not infrequent. Œsophagoscopy was considered inadvisable.

If further investigation be advisable, examination with the sound and the œsophagoscope is now in order. The passing of the sound should precede that of the œsophagoscope. Thus, we learn if the diameter of the gullet above the spot at which the capsule is arrested will allow of the passing of a tube of the diameter of the œsophagoscope.

The best bougies are probably those having a whalebone handle and interchangeable olive-shaped metallic heads of different sizes. They are neither too rigid nor too flexible. The method of use and the information they afford in cases of œsophageal carcinoma, œsophageal spasm, and stricture from extra-œsophageal causes other than aneurysm are well known and need no comment.

Œsophagoscopy is the last diagnostic means in this proposed scheme. It is a method often disagreeable to the patient, and if

done roughly or inopportunely, of considerable danger. Its employment demands a wise discretion and good sense on the part of the operator.

The technique of the examination is as follows:

1. The stomach should be empty, and the œsophagus, if dilated, should be washed out. No sound should have been passed for at least twenty-four hours.

2. An injection of $\frac{1}{4}$ grain of morphine and $\frac{1}{100}$ grain of atropine is given half an hour previously.

3. The structures of the throat are well anesthetized with a 10 per cent. solution of β-eucaine with adrenalin.

The patient may be examined in the sitting, left lateral, or dorsal position. I prefer, when possible, to have the patient seated on a cushion on the floor. The back and feet are placed against firm supports; another cushion is put under the knees. An assistant supports the head, which is dorsally flexed.

The patient is told to breathe quietly; to swallow when told to do so; to raise his hand if in pain, since he cannot speak; and to pay no attention to drooling saliva.

I use the Einhorn instrument, which carries its own light. I watch its passage over the back of the tongue past the epiglottis into the pharyngeal slit. The mandrin is then introduced and the instrument is carried past the inferior constrictor. The mandrin is then withdrawn and the further progress of the instrument watched. The previous investigation will have told us what bore instrument can be used and the length of instrument to be chosen. It is carried to the site of the lesion.

The appearance of the lesion is in many instances quite characteristic: the wrinkled sac of a diverticulum, the rosette-like appearance occasioned by a local spasm, the bleeding ulcerated nodules of a carcinoma if seen are readily recognized. In other instances the picture presented by extra-œsophageal growths is exactly similar to that seen in some cases of carcinoma.

The object of this paper, however, is not to describe the correct technique of, or the information gained by, hypopharyngoscopy, probing with sounds, and œsophagoscopy, and I have purposely refrained from speaking of double sounds and apparatus for determining the intra-œsophageal pressure. Rather it is threefold:

1. To record how simply one can often clinically gain serviceable information in cases of œsophageal diverticulum.

2. To show that radiography can be of considerable service in the investigation of these patients.

3. To advocate the adoption of the above outlined system in the investigation of patients afflicted with difficulties of deglutition. It will, I believe, prevent some deaths and will undoubtedly save much distress to a class of patients who already suffer much. Its advantage for teaching purposes is obvious.

THE GASTRIC SECRETION.

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Perhaps no one field in physiological or pathological chemistry contains more of interest than the results of a systematic investigation of the gastric secretion. This paper is based on a study of the vomitus from 81 patients, mostly derived from postanesthetic vomiting. No food particles were present in any of the specimens, for in Mount Sinai Hospital, as in other institutions, food and water are withheld for several hours before the patient is anesthetized. The results, as one can see from the tables, are of some interest and at some variance with opinions held by other observers.

Taking up the first of the columns, we find that the amounts vary from 20 c.c. to 240 c.c. This variance unquestionably is an individual one dependent on the length of the anesthesia, thereby influencing the amount of mucus swallowed, the watery element acting as a chemical stimulant; the psychical effect of both operation and anesthesia, the nervous temperament, etc., of the patient, all or each of which may influence the amount of gastric secretion. Larger amounts of gastric secretion may also be due to an existing functional condition or to a transudation following an abnormal resorptive power. Normally the fasting stomach may contain 10 to 20 c.c. of fluid.

The color question was also of interest: it was brown in 22, green in 37, colorless in 6, yellow in 7, gray in 8. Very few were perfectly clear, mostly all being turbid from the mucus present. Of the 37 green specimens, only 32 contained bile, thus confirming the opinion that not every green stomach contents is caused by the presence of bile. Mucus in various amounts is also influenced by some of the causes which tend to increase the amount of gastric secretion. It may be caused by mouth lesions—stomatitis, ptyalism, pharyngitis, etc. —or by a catarrhal gastritis. Normally, there is always a little mucus present. In 6 there was no mucus, little in 37, moderate in 13, and much in 25.

The normal chemical reaction of the gastric secretion is acid, due to the presence of free acid, partly to acid salts (monophosphates), and partly to both. In the 81 specimens, 66 were acid to litmus, 9 were alkaline, and 5 were neutral.

The Congo paper reaction was positive in but 27 and negative in 53. This reaction is very generally used to determine the presence of free acids, and one is somewhat struck by the fact that 66 of the specimens were acid to litmus and but 27 of these positive to Congo, assuming that the gastric acidity is due to the free acids present.

TABLE I.

Case No.	Diagnosis.	Amount c.c.	Color.	Mucus.	Reaction.	Congo.	Bile.	Total nitrogen per cent.	Ammonia per cent.	Chlorine per cent.
1	Colporrhaphy	32	....	None	...	.....	Negative	0.168	0.018	0.231
2	Carcinoma of kidney	95	Brown	None	Acid	Negative	Negative	0.147	0.008	0.277
3	Endometritis	120	Yellow	Little	Acid	Negative	Positive	0.104	0.017	0.422
4	?	22	Yellow	Little	Neutral	Negative	Negative	0.073	0.0017	0.177
5	Pregnancy	31	Green	Little	Acid	Negative	Positive	....	0.015	0.419
6	Abortion	29	Brown	Little	Acid	Negative	Positive	0.148	0.015	0.397
7	Diseased appendages	88	Brown	Little	Acid	Positive	Negative	0.241	0.029	0.500
8	Renal colic	29	Colorless	Little	Alkaline	Negative	Negative	0.133	0.0204	0.256
9	Tumor of colon	65	Brown	Little	Acid	Positive	Positive	0.172	0.0204	0.497
10	Hemorrhoids	38	Brown	Much	Acid	Negative	Negative	0.246	0.035	0.532
11	Chronic nephritis	68	Brown	Little	Acid	Positive	Negative	0.199	0.029	0.536
12	Hemorrhoids	28	Green	Little	Acid	Negative	Positive	0.256	....	0.653
13	Ectopic gestation	94	Brown	Little	Alkaline	Negative	Negative	0.133	....	0.266
14	Carcinoma of rectum	50	Colorless	Much	Acid	Negative	Positive	0.014	0.030	0.401
15	Hernia	45	Colorless	Much	Acid	Negative	Positive	0.165	0.027	0.348
16	Appendicitis	46	Yellow	None	Alkaline	Negative	Positive	0.095	0.058	0.358
17	Cholelithiasis	102	Yellow	Little	Neutral	Negative	Negative	0.035	0.006	0.099
18	?	90	Colorless	Much	Acid	Negative	Positive	0.143	....	0.419
19	Appendicitis	25	Brown	None	Alkaline	Negative	Positive	0.201	0.054	0.398
20	?	60	Brown	None	Acid	Positive	Negative	0.145	....	0.344
21	Cholecystectomy	50	Green	Little	Acid	Positive	Positive	0.090	0.024	0.440
22	?	240	Gray	None	Neutral	Negative	Positive	0.123	0.036	0.277
23	?	150	Green	Little	Acid	Positive	Positive	0.070	0.027	0.270
24	?	64	Brown	Little	Acid	Positive	Negative	0.160	0.030	0.866
25	Appendicitis	60	Brown	Small	Acid	Positive	Negative	0.140	0.023	0.472
26	Ventral hernia	90	Green	Much	Acid	Negative	Positive	0.154	0.014	0.284
27	Hematoma	22	Green	Much	Acid	Negative	Positive	0.132	....	0.341
28	Appendicitis	77	Green	Moderate	Acid	Negative	Positive	0.199	0.018	0.124
29	Carcinoma of rectum	72	Green	Much	Acid	Negative	Positive	0.238	0.034	0.479
30	Appendicitis	67	Green	Much	Acid	Negative	Positive	0.126	0.017	0.238
31	Appendicitis	30	Green	Much	Acid	Negative	Positive	0.126	....	0.312
32	Glands of neck	53	Brown	Moderate	Acid	Positive	Positive	0.157	0.022	0.415
33	Nephropexy	32	Green	Moderate	Acid	Negative	Positive	0.104	0.010	0.405
34	Appendicitis	160	Green	Much	Acid	Negative	Positive	0.104	0.017	0.287
35	Tumor of breast	45	Green	Much	Acid	Positive	Positive	0.115	0.019	0.394
36	Appendicitis	36	Green	Little	Neutral	Negative	Positive	0.132	0.046	0.373
37	Carcinoma of rectum	67	Brown	Little	Acid	Positive	Positive	0.168	0.025	0.465
38	Salpingo-oöphorectomy	28	Green	Little	Acid	Negative	Negative	0.081	0.007	0.145
39	Appendicitis	80	Brown	Much	Acid	Positive	Negative	0.036	0.012	0.433
40	Appendicitis	21	Green	Little	Acid	Positive	Positive	0.056	....	0.298
41	Gall-bladder	20	Brown	Little	Acid	Positive	Negative	0.362	....	0.454
42	Appendicitis	65	Green	Moderate	Acid	Negative	Positive	0.082	0.019	0.252
43	Tuberculous glands	52	Green	Moderate	Acid	Negative	Positive	0.244	0.034	0.366
44	Hernia	32	Colorless	Little	Acid	Negative	Positive	0.120	0.003	0.383
45	Appendicitis	78	Green	Much	Acid	Negative	Positive	0.210	0.012	0.273
46	Hernia	124	Green	Moderate	Acid	Negative	Positive	0.178	0.020	0.398
47	Ovarian cyst	68	Green	Much	Acid	Positive	Negative	0.193	0.019	0.383
48	Gastrostomy	65	Brown	Little	Acid	Negative	Positive	0.134	0.012	0.128
49	Appendicitis	85	Gray	Little	Acid	Negative	Positive	0.087	0.017	0.145
50	Appendicitis	95	Green	Mucus	Acid	Positive	Positive	0.154	0.018	0.348
51	Glands of neck	45	Brown	Little	Acid	Negative	Negative	0.224	0.039	0.539
52	Gall-bladder	140	Green	Much	Acid	Negative	Positive	0.120	0.025	0.351
53	Appendicitis	43	Green	Little	Acid	Positive	Positive	0.145	0.023	0.532
54	Appendicitis	40	Gray	Moderate	Alkaline	Negative	Positive	0.249	0.044	0.490
55	Fistula-in-ano	30	Yellow	Moderate	Acid	Negative	Positive	0.134	....	0.131
56	Varicose veins	36	Gray	Little	Alkaline	Negative	Positive	0.210	0.017	0.436

TABLE I—*Continued.*

Case No.	Diagnosis.	Amount c.c.	Color.	Mucus.	Reaction.	Congo.	Bile.	Total nitrogen per cent.	Ammonia per cent.	Chlorine per cent.
57	Abdominal cyst	34	Green	Much	Acid	Positive	Negative	0.098	0.041	0.571
58	Hernia	51	Green	Little	Acid	Positive	Positive	0.176	0.019	0.678
59	Appendicitis	25	Green	Much	Acid	Negative	Positive	0.087	....	0.224
60	Appendicitis	75	Green	Little	Alkaline	Negative	Positive	0.143	0.014	0.366
61	Tumor of breast	50	Green	Little	Alkaline	Negative	Positive	0.143	0.020	0.327
62	Appendicitis	90	Brown	Little	Acid	Positive	Positive	0.263	0.029	0.437
63	Appendicitis	60	Colorless	Moderate	Acid	Positive	Positive	0.148	0.015	0.408
64	Appendicitis	40	Green	Much	Acid	Negative	Positive	0.109	0.017	0.412
65	Salpingo-oöphorectomy	50	Brown	Moderate	Acid	Positive	Positive	0.146	0.015	0.344
66	Appendicitis	60	Green	Little	Acid	Negative	Positive	0.140	0.017	0.415
67	Cholecystectomy	70	Brown	Much	Acid	Positive	Negative	0.148	0.019	0.284
68	Hemorrhoids	78	Brown	Little	Acid	Positive	Positive	0.137	0.020	0.387
69	Hemorrhoids	63	Green	Much	Acid	Negative	Positive	0.134	0.036	0.366
70	Hemorrhoids	37	Green	Little	Acid	Positive	Positive	0.120	0.036	0.415
71	Umbilical hernia	70	Gray	Moderate	Acid	Negative	Positive	0.120	0.036	0.437
72	Colostomy	70	Yellow	Much	Acid	Negative	Negative	0.216	0.017	0.383
73	Gall-bladder	70	Green	Little	Acid	Negative	Positive	0.109	0.031	0.412
74	Bunion	43	Gray	Moderate	Acid	Negative	Negative	0.129	0.027	0.380
75	Hernia	31	Green	Little	Neutral	Negative	Negative	0.193	0.036	0.621
76	Hemorrhoids	41	Gray	Little	Alkaline	Negative	Negative	0.182	0.032	0.366
77	Hernia	95	Green	Much	Acid	Negative	Positive	0.117	0.013	0.398
78	Appendicitis	80	Brown	Moderate	Acid	Positive	Positive	0.098	0.012	0.348
79	Osteomyelitis	80	Gray	Much	Acid	Negative	Positive	0.174	0.029	0.330
80	Appendicitis	30	Green	Much	Acid	Positive	Negative	0.140	....	0.479
81	Hernia	31	Gray	Little	Acid	Negative	Negative	0.160	0.030	0.465
							Average	0.147	0.022	0.378

Ratio of ammonia to total nitrogen, 1 to 6.6. Total of nitrogen to chlorine, 1 to 2.6.

This result points to a conclusion that Congo paper is hardly sensitive enough to rely on even for a qualitative test, and to use instead, according to Leo, a solution of Congo red, which is much more delicate than the paper. He shows that while Congo paper gave a positive reaction when 0.01 per cent. HCl was present, a solution of Congo red gave a positive reaction with but 0.0009 per cent. HCl.

The presence of bile in 56 of the specimens and its absence in 25 was rather interesting. Bile in the gastric secretion occurs as a regurgitation into the stomach—frequently seen in the vomitus whenever the vomiting may be very intense or frequently repeated. The presence of bile, ever so faint, signifies an antiperistalsis of the duodenum. Larger amounts of bile point to a deficient stomach motility, an atony, or an ectasia. Schüler even says that large amounts of bile aid in making a differential diagnosis between an atonic ectasia and an ectasia due to a pyloric stenosis, being much larger in amount in the former.

The passage of bile into the stomach during digestion seems, according to several observers, to have no disturbing action on gastric digestion. The acid contents of the stomach, containing an abundance of proteins, gives with the bile a precipitate of proteins and bile acids. The precipitate formed easily redissolves in an excess of bile, and also in the NaCl formed by the neutralization of the HCl of the gastric juice. This may take place even in a faintly acid reaction.

The chemical reaction of bile is feebly alkaline, and when in the stomach unquestionably neutralizes the HCl, and this perhaps accounted for the small number of Congo positive reactions. Of the 27 positive Congo reactions, 16 showed the presence of bile; of the 53 negative Congo reactions 40 showed the presence of bile.

From this it can be assumed that, while the bile has but little influence on the acid reaction to litmus, it does appear to have some effect on the Congo reaction. There were but 9 cases in which the reaction was alkaline, and in 6 of these bile was present. In these 6 cases the chlorine percentage was comparatively high, while in the other 3, in which bile was absent, this percentage was low.

The percentage of total nitrogen varied from 0.014 to 0.362, the average being 0.147. In recent years more attention has been given to the nitrogen content of the gastric secretion, particularly by Salomon for the purpose of diagnosticating carcinoma of the stomach. He maintained that if in 100 c.c. of normal salt solution used to rinse out the empty stomach, he found more than 25 mg. of total nitrogen, it indicated the presence of a carcinoma. In none of the patients from whom the specimens were obtained was carcinoma diagnosticated, thereby preventing confirmation of his opinion.

Ammonia in the stomach secretion is regarded by some as a pathological constituent, by others (Rosenheim and Strauss) as normal. In each of the 81 specimens the ammonia content was a fairly constant one, as will be seen from the table—an average of 0.022 per cent.

Chlorine, a normal component of the gastric juice, is a most important element for the formation of the HCl. How this acid is formed we are not at all certain. According to the older observers, the amount of chlorine present in gastric juice is more than would suffice to form chlorides with all the bases present, and the excess, if regarded as existing in the form of HCl, corresponds exactly to the amount of free acid present. At some subsequent time I shall publish results on this question.

Looking at the chlorine figures, it can be seen that these vary considerably. Realizing that chlorine enters materially into the quantity of HCl formed, we find that a positive Congo reaction was obtained when there was 0.27 per cent. or upward of chlorine.

Although 60 of the cases showed the presence of more than 0.30 per cent. chlorine, the Congo reaction was positive in 24 and negative

in 36. Of the positive ones, bile was present in 14 and absent in 10. Of the 36 negative cases, bile was present in 29 and absent in 7. From this we may be permitted to conclude that the bile present in some way acts on the chlorine and hence gives a negative Congo reaction. This appears to indicate that bile in the stomach—how frequently it is present we can not say, because we assume it is only present as a result of vomiting or in pathological conditions—influences the acidity, and may be used therapeutically in cases of hyperacidity with at least similar or perhaps better results than attend the use of alkalies. At present I am engaged in a study of this question, and in a subsequent communication will give my results.

In making studies on the total nitrogen, ammonia, and chlorine contents of the gastric juice, one must not lose sight of the saliva factor. To allow for this, I examined these elements in ten normal salivas.

TABLE II.—SALIVA.

No.	Total nitrogen.	Ammonia.	Chlorine.
1	0.0616 per cent.	0.0085 per cent.	0.0568 per cent.
2	0.0504 per cent.	0.0085 per cent.	0.0852 per cent.
3	0.0658 per cent.	0.0238 per cent.	0.0816 per cent.
4	0.0546 per cent.	0.0187 per cent.	0.0461 per cent.
5	0.0826 per cent.	0.0255 per cent.	0.0994 per cent.
6	0.0546 per cent.	0.0120 per cent.	0.0460 per cent.
7	0.0434 per cent.	0.0050 per cent.	0.0710 per cent.
8	0.0364 per cent.	0.0170 per cent.	0.1171 per cent.
9	0.0546 per cent.	0.0170 per cent.	0.0532 per cent.
10	0.0644 per cent.	0.0153 per cent.	0.0710 per cent.
Average	0.0568 per cent.	0.0151 per cent.	0.0727 per cent.

Ratio of ammonia to total nitrogen, 1 to 3.76. Total of nitrogen to chlorine, 1 to 2.28.

From these ten cases an average was obtained for comparison with the same constituents of the gastric secretion, and it will be noticed that the total nitrogen in the latter is almost three times that of the saliva, the ammonia twice, the chlorine more than five times.

To Dr. S. Bookman, thanks are due for many suggestions in the course of this study.

LOCAL ASPHYXIA OF THE EXTREMITIES (RAYNAUD'S DISEASE) WITH THE HITHERTO UNDESCRIBED COMPLICATION OF INTERMITTENT ACHYLIA GASTRICA.

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Local asphyxia and symmetrical gangrene are not two different diseases, but two degrees of one and the same malady. The latter condition is often absent. While the word "asphyxia" expresses a definite pathological state, the term "local" may be misleading, since, according to Raynaud, search for the origin should not be confined to the affected parts. The following case was first seen at the Beth-Israel Dispensary, January 12, 1909.

Celia R., aged twenty-three years, single, a dressmaker, born in Russia, has lived two and one-half years in America.

Family History. Father and a paternal uncle have hemorrhoids; mother is "very nervous;" one brother has chronic indigestion; sister is subject to attacks of long-lasting singultus. There is no history of a disease like the patient's.

Personal History. Hygienic surroundings are poor; the diet is mixed; no alcoholic beverages are used; tea and coffee in moderation. Although she can eat everything, the patient does not enjoy her food.

Previous Diseases. Has had the ordinary diseases of childhood. Five years ago in Russia had malaria. Syphilis is denied.

Menstrual History. Menstruation began at the age of fourteen years; interval twenty-eight days; duration four to seven days; flow profuse; pain present for two days. For the last three years there has been some irregularity in the interval, which is now only two or three weeks.

Present Illness. Dates back to her malaria, five years ago. At first the fever was quotidian in type, the attacks lasting several hours. After several weeks the hyperpyrexia and sweating began to occur every other day. Then for three months large doses of quinine were given. The patient remained very weak and was under medical care for three months more. Soon after she recovered from her post-malarial weakness she noticed that one finger of the right hand (which one she cannot remember) became white and "dead." Motion was normal, but sensation was lost. The whiteness extended to all the phalanges of both hands, and remained unchanged for a year's time, when the skin began to assume a bluish aspect, while loss of sensation and coldness became quite marked. Later the feet became similarly affected. The condition, improving somewhat in summer, is worse on cold winter days. The patient notes that even

on hot days she does not sweat like other people, and is not compelled to change her underwear more frequently in summer than in winter, although it very seldom happens that a few drops of cold prespiration appear on the forehead.

Physical Examination. The skin, especially that of the face, is dry, very tense, and lacking in elasticity. For the last reason drawing the inferior eyelid from the eyeball is possible only with difficulty, and the upper lid droops somewhat. It is almost impossible to raise the skin of the extremities and face in folds. Both hands have a bluish appearance, and to the touch they are dry and icy cold. The feet, especially the toes, feel the same, but have not the bluish appearance of the hands. The fingers of both hands are spread and held in slight flexion. Complete extension is impossible.

With the exception of a few small areas where sensation is diminished, the skin, together with the mucous membrane of the anterior part of the tongue, is entirely insensitive to pinpricks. The temperature is quite lost in the affected parts of the hands and feet and is much diminished over the greater part of the remainder of the skin. The tactile sense is somewhat perverted. The muscular sense and the stereognostic sense are normal. The knee-jerks and the Achilles-jerks are slightly exaggerated. There is no ankle clonus.

The circulatory apparatus is normal. The pulse is palpable in the posterior tibial, and in the dorsal artery of the foot, as well as in the radial. No thickening of the arterial wall can be detected. The blood pressure is 130 mm. Hg. Neither the liver nor the spleen is palpable.

The pupils are equally dilated. There is slight blepharitis. The papillæ are of normal color; the arteries contracted, their lumen being about one-half that of the veins. There is slight hypermetropia (R., 0.5; L., 0.25). Otherwise the eyes are normal.

The Blood. Hemoglobin, 80 per cent.; the red cells, 6,030,000; the color index, 0.66; the leukocytes, 7400. Differential count: Polymorphonuclears, 280 (70 per cent.); large mononuclears, 16 (4 per cent.); small mononuclears, 83 (20.75 per cent.); transitionals, 8 (2 per cent.); eosinophiles, 10 (2.5 per cent.); basophiles, 0 (0 per cent.); unclassified, 3 (0.75 per cent.). The red cells vary slightly in size and shape. No malarial plasmodia and no free pigment were found.

The urine was examined six times. The twenty-four-hour amount varied from 950 to 1450 c.c. The acidity (using one drop of phenolphthalein as an indicator and titrating with decinormal sodium hydrate solution) varied from 30 to 60. Neither albumin nor sugar was ever found. Indican was present to slight excess. The centrifuged sediment contained an excess of urates. Casts were never found.

A radiogram of the hands show some slight absorption of bone in the phalanges (Figs. 1 and 2).

The Stomach Contents. January 14: One hour after an Ewald-Boas test breakfast, 8 c.c. of very thick and nearly dry material, with a very little fluid and some exceedingly tenacious mucus, was expressed. It took some time to clear the tube of the particles of roll, which appeared absolutely unchanged. It was evident that no chymification was going on. Free HCl, negative to Congo red and to phloro-

FIG. 1.—Radiogram of the left hand, showing slight absorption of bone in the metacarpals.

glucin-vanallin. Maltose (with Fehling's solution), positive. Lactic acid, negative. Total acidity, not determined. On the same morning the acidity of the urine was 60. The hands, especially the fingers, were blue, the feet a little less so. (It was a very cold day.)

January 16. Ewald-Boas breakfast eaten at 9 A.M., expressed at 10. Amount about 20 c.c., of the same gross appearance as the last.

Mucus, present. Free HCl, negative. Total acidity, 8. Rennet, pepsin, and lactic acid, negative. Acidity of the urine, 58. The fingers and toes very blue.

January 18. One hour after a similar breakfast, 30 c.c. was expressed. This was more fluid and there was no mucus. The particles of roll were much changed, as if chymification were pro-

FIG. 2.—Radiogram of the right hand, showing absorption of bone in the metacarpals. Similar to that seen in the left hand.

ceeding. Free HCl, 8. Total acidity, 28. Acidity of the urine, 48. The fingers and toes had no suggestion of blueness.

On six later occasions the gastric contents were examined after a test breakfast. Twice free HCl and pepsin were absent, mucus was present, and the total acidity was less than 12. These findings corresponded to those cold days when the symmetrical asphyxia and the cyanotic appearance of the extremities were most marked. On two

of these days the eyegrounds were examined, with the results already noted. On the days when free HCl was present (ranging between 4 and 8) and the total acidity reached 20 or 30 (once as high as 40) the fingers and toes looked red.

To recapitulate, we see: (1) That the patient belongs to a neurotic family. (2) That as far as the presence of hemorrhoids points to an angioneurotic condition there is this predisposition also; but that the patient herself is not neurasthenic nor hysterical. (3) That she was in perfect health until the age of eighteen, when, soon after an illness with an obstinate form of malaria, she noticed the development of her present malady. (4) That though the condition of all four extremities is better in the summer, yet even then her skin does not functionate so actively as the skin of other people. (5) That the pain sense is lost not only in the affected parts, but nearly all over the skin and on the anterior part of the tongue, with diminution of the senses of temperature and touch. (6) That while the heart and palpable vessels are normal, the small arteries of the fundus show a marked contraction when the asphyxia of the extremities is most pronounced. (7) That there is a slight secondary anemia. (8) But the most striking feature is the fact that, without dyspeptic symptoms, there is a lack of free HCl and the presence of mucus in the stomach contents on those days when the fingers and toes show the most characteristic picture of local asphyxia; while on the days when the extremities are red no mucus is present and the quantitative examination shows merely hypoacidity.

In the literature we find malaria mentioned as a relatively frequent cause of local asphyxia, which may develop to a slight degree in the course of intermittent fever. Raynaud[1] was aware of the intermittent character of the disturbance, and also of the fact that after the fever has subsided the convalescent may suffer from attacks of local asphyxia. He gave quinine in such cases. Of this his Cases V and VIII are good illustrations. (Case V.—Woman attacked by tertian fever in March. Local asphyxia and cyanosis noted in April. Case VIII.—Woman ill for three months with tertian fever. A few months later local asphyxia intervened.) Petit and Verneuil[2] report cases in which fever preceded the local asphyxia for years, and insist on the importance of the former as a cause. Brehier (quoted by Monro[3]) goes even so far as to suggest that local asphyxia is but a latent form, "une forme larvée," of malaria. Again, Petit and Verneuil point out that the malarial poison is not sufficient, but that there must be other etiological factors, and that exposure to cold is probably one of these. In our case no history of the latter cause could be elicited.

[1] Local Asphyxia and Symmetrical Gangrene of the Extremities. Translated by Thomas Barlow; Selected Monographs; New Researches on the Nature and Treatment of Local Asphyxia of the Extremities. Translated by Thomas Barlow.

[2] Revue de chirurgie, 1883.

[3] Raynaud's disease.

According to Raynaud himself, the site of the lesion is probably in the cord, and so the symmetry of the affection is explained, as well as the good results following the application of a descending current to the spine. Mourson (quoted by Monro) thought the vascular spasm to be due to irritation of the vessels of the cord by melanemic deposits. This pathological condition might be present in my patient, although free pigment was not demonstrated in the blood. The peculiar skin, with the history of anidrosis even in the intervals between the attacks of local asphyxia, would speak for some form of scleroderma, a complication not so rare in Raynaud's disease. Stürmdorf[4] describes an analogous picture of the skin, especially that of the face, "la masque sclérodermique" of the French. The near approach to anesthesia of the skin, with the much diminished acuity of the temperature sense and tactile sense, suggests syringomyelia. One of Braman's[5] cases was very similar to ours. Although anesthesia is very frequent in hysteria and, according to Osler,[6] the concurrence of Raynaud's disease and hysteria is common, the patient did not exhibit any of the ordinary stigmas of hysteria, and the distribution of the anesthetic areas was always the same.

The contraction of the papillary arteries would give more support to the theory that local asphyxia is a neurosis in which the local symptoms are due to spasm of the arterioles. Fox[7] reports a case of sudden paroxysmal impairment of vision, with such changes in the arteries of the fundus. My patient had no disturbance of vision. The eyegrounds were examined simply because Raynaud called attention to the changes therein. According to his views this condition is not associated with spasm of the arteries of greater size. Calmette (quoted by Monro) showed that patients, who have recently suffered, or are still suffering, from malarial cachexia exhibit paroxysmal narrowing of the papillary vessels.

Some explanation must be given of the radiogram of the patient's hands, taken by Dr. Isaacs, to whom I take this opportunity to express my hearty thanks. This shows some very slight absorption of bone. Carl Beck[8] is of the opinion that the tissue changes in Raynaud's disease are not confined to the soft parts, but affect the bones as well. He reports two cases with radiograms to prove this assumption.

The examinations of the urine showed simply an excess of uric acid crystals and a varying degree of hyperacidity. Haig (quoted by Monro) thinks many symptoms of Raynaud's disease resemble those

[4] Symmetrical Gangrene, Medical Record, 1891

[5] Fälle symmetrischer Gangrän, Verhl. d. Deutsch. Gesellsch. f. Chirurg., 1889, xxix, 37.

[6] The Cerebral Complications of Raynaud's Disease, AMER. JOUR. MED. SCI., November, 1901.

[7] Two Cases of Raynaud's Disease with Ocular Symptoms; One Case Complicated by Scleroderma, Jour. Cutaneous Dis., August, 1907.

[8] Some New Points in Regard to Raynaud's Disease, AMER. JOUR. MED. SCI., November, 1901.

of "uric acidemia," and in one severe case he was able to demonstrate a great excess of uric acid in both the blood and the urine. He believes that uric acid causes the contraction of the arterioles.

We come now to a consideration of the gastric analyses. After the second examination we thought that the anacidity was of nervous origin, as the patient was not suffering from any disease which might lead to achylia gastrica, such as pernicious anemia, nephritis, or tuberculosis. Slight secondary anemia was indeed diagnosticated, but such a condition would not be sufficient to cause any marked chemical changes in the gastric secretion. The fact that the patient did not exhibit any subjective symptoms of gastric disturbance would not exclude achylia gastrica. Knud Faber and Lange[9] published not long ago several cases (Cases VII to XI of their series) which ran along without any symptoms and without demonstrable cause.

The presence of mucus speaks against achylia gastrica, if we accept Einhorn's[10] use of the term, since he requires absence of mucus to establish such a diagnosis. A gastric catarrh, on the other hand, with anacidity would not exist for any time without symptoms. Moreover, the patient is much younger than the average sufferer from this disease, and the analyses showed a varying condition of the gastric secretion. In catarrh of the stomach the findings are usually constant. Some other explanation for this variation must be sought. In spite of Hayem's disbelief in nervous achylia gastrica, we must agree with Einhorn that such a form probably does exist, especially since his well-known illustrations give strong support to his opinion. I would classify my case as one of paroxysmal achylia gastrica and paroxysmal mucorrhœa, and would submit that the same etiological factor produces both affections, together with the attacks of local asphyxia in the extremities and the changes in the eyegrounds; and that if the last, as is unquestionably the case, is due to spasm of the arterioles, so may be all the preceding. It is not unlikely that all the above symptoms should occur together, or that the gastric symptoms should be caused by arterial spasm and vary with the intensity of the spasm.

It is, indeed, possible that there are two types of achylia gastrica: The first, of nervous origin, would take the form of a paralysis of the secretory fibers to all of the gland cells; the second, of vascular origin, would cause rather a temporary asphyxia of the same cells, with a resulting alteration in the secretion. Pawlow[11] points to the peculiar changes in the gastric juice following section of the vagus as evidence of the role played by the sympathetic in exciting the changes. Sympathetic and vagus seem to extend mutual aid in the performance

[9] C. Lange, Die Pathogenese u. Aetiologie der chronischen Achylia Gastrica, Ztschr. f. klin. Med., 1908, 66.

[10] A Further Report on Achylia Gastrica, Medical Record, 1905.

[11] The Work of the Digestive Glands. Translated by W. H. Thompson, 1902.

of this function. Now, as is well known, the sympathetic is much richer in vasoconstrictor fibers than the vagus, and it is not unlikely that it influences gastric secretion chiefly through its action on the arterioles of the gastric mucosa. Stimulation of the sympathetic was held by Raynaud to be responsible for the spasm of the retinal arteries, as well as of the arterioles of the extremities, on which, in turn, depends the local asphyxia. The experiments of Adamiuk (quoted by Raynaud) are of interest in this connection, for he states that if in a curarized animal the sympathetic ganglion at the level of the seventh and eighth cervical vertebræ be stimulated, an ophthalmic examination will reveal the same distribution of blood as in glaucoma, that is, the veins are greatly distended and the arteries contracted.

In my case, although contraction of the papillary arteries and achylia gastrica were found together on two occasions, no coincidence of the opposite conditions, namely, normal eyegrounds and normal gastric secretion was demonstrated. However, the achylia and the cyanosis did appear and disappear together. It is easily conceivable that a spinal irritation might result in contraction of the vessels of four different regions, *e. g.*, hands, feet, retina, and stomach. The double innervation of one of these regions corresponds to that of the salivary glands. By stimulating the cerebral fibers running to the submaxillary gland in the chorda tympani, an abundant secretion of thin liquid is produced; if the sympathetic be stimulated, only a few drops of viscid fluid are secreted. The sympathetic fibers have been shown to end around the vessels of the gland.

Furthermore, we know from the experiments of Claude Bernard (quoted by Abderhalden[12]) that if the lingual nerve which carries the cerebral fibers to the submaxillary gland be cut and the peripheral end stimulated, the bloodvessels in the gland become distended and the blood in the veins assumes a bright red color similar to that of the arterial blood. At the same time there is an increased secretion of saliva. On the other hand, by stimulating the fibers of the sympathetic the bloodvessels are contracted, the blood streams more slowly, and the flow from the veins is small in amount and of a dark red color. It is fair to say that in the latter condition the activity of the secretion is diminished because of the stasis in the veins or a local asphyxia of the glandular tissue. It is true that Heidenhain showed that the innervation of the bloodvessels is not the sole function of the above-mentioned nerve, yet it is unquestionably an important one. In like manner the secretion of gastric juice depends not wholly on vagus action, but to some extent also on that of the sympathetic, although the action of the latter alone results in an abnormal secretion containing but little pepsin. In our case the gastric contents showed none of the ferment and very little liquid.

[12] Text-book of Physiological Chemistry. Translated by Wm. T. Hall.

A few further references may be of interest. Valentine Calonne,[13] in his exhaustive thesis on the subject of Raynaud's disease and its complications, says that disturbances of the gastro-intestinal tract are very rare. Abercrombie[14] narrates the history of a boy, aged three years, who, before the onset of asphyxia was very "yellow," and who when his hands were cold cried on account of the pain in his stomach. When his hands became warm again, the pain in the belly disappeared. Paroxysmal hemoglobinuria was also noted in this case. One of Fox's patients suffered from nausea in the morning, and often vomited after eating. A second patient of his with gastro-intestinal disturbance complicating Raynaud's disease vomited frequently after eating and had frequent attacks of diarrhœa. It is possible that the diarrhœa was due to the achylia, a common cause of this condition. The attacks might indicate a spasm of the arterioles in the gastric glands, and an analysis of the stomach contents, had it been made, might have shown the same condition of intermittent achylia as in my case.

CLINICAL OBSERVATIONS IN HEART-BLOCK.

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Bradycardia, dyspnœa, and loss of consciousness or convulsions were first described as a symptom group by Morgagni, about 1750, followed by Stokes, in 1846, Adams, in 1872, and was given the name of Stokes-Adams disease by Huchard, in 1893. The discovery of the atrioventricular bundle by Kent in cold-blooded, and by His in warm-blooded, animals, and later in man, stimulated study of the functional relationship of auricle and ventricle, resulting, through the experimental and clinical work of Hering and Erlanger, in the recognition of the association of conditions of heart-block and the Stokes-Adams syndrome. Extended clinical knowledge has shown the error of the earlier opinion that these conditions are identical, for it is now recognized that either may exist without the other. There may be heart-block without the Stokes-Adams symptoms and Stokes-Adams symptoms without heart-block. The following cases are put on record to emphasize this well, though somewhat newly, recognized fact, and to contribute to the literature a few clinical observations of a sort that must be

[13] Associations pathologiques dans la maladie de Raynaud, Paris, Thèse, 1904.

[14] Some Points in Connection with Raynaud's Disease, Arch. of Pediatrics, 1886, 567, 573.

much more numerous and extensive before any final classification of the various types of the complex condition can be made. Two of the cases illustrate heart-block with, and one heart-block without, the Stokes-Adams syndrome.

CASE I.—*Heart-block with Stokes-Adams Syndrome.* The patient, a housewife, aged sixty years, has been twice married and has four living children, one of whom, a daughter, has a congenital heart lesion. She has always eaten well, used wine and whiskey daily, coffee in moderation, and taken no exercise. She has been obese for years. There has never been a serious illness, but she has suffered several nervous shocks and had much responsibility.

The present illness began in 1906, with shortness of breath on exertion, while the patient was living at an altitude of 7000 feet. There was no other trouble until June, 1908, when, after dancing at night and running for a train the next day, there was unusual exhaustion. The day following, on the train, there was a sudden fainting attack, and the day after, the patient fell in the street in syncope, revival being immediate. At this time a physician found the pulse rate 20. Observation has since been continuous. During June, 1908, there were one or two syncopal attacks a day. Confinement in bed was enforced, and by July these subsided, the pulse rate rose to 45, and the patient went about without trouble, until September, when the pulse was 25 and there were renewed faints. On November 8, 1908, the pulse became 20, then 15, and later 12. With this were serious faints and epileptiform convulsions, numbering, at most, twenty a day. Tincture of digitalis in five-drop doses was given, and coincidently the pulse rate rose to 25 and there was steady improvement. Later the pulse rose to 35, when the convulsions and syncopal attacks ceased. The patient crossed the continent, and en route, at an altitude of 7000 feet, the pulse was 70. Upon reaching New York it was 65. On December 7, 1908, the pulse tracings reproduced as Fig. 1 were made.

Physical Examination. December 11, 1908. The patient is stout and of good color. The heart is not enlarged to percussion; it shows a slight harsh systolic murmur at the apex and at the base; the latter is heard over the aorta. The pulse rate is 48 to 60, changing suddenly from one to the other. The arteries are full and slightly thickened. The arterial pressure is systolic, 170 mm. Hg.; the diastolic, 80 mm. Hg. The liver edge is just palpable. There is no œdema. The knee-jerks are active.

Clinical Course. During the next week the pulse rate varied between 38 and 56, and there were no symptoms. On December 24, 1908, the rate fell to 30 and there was discomfort, but no syncope. No intermediate heart sounds could be heard. Tincture of digitalis, 5 minims three times daily, and strychnine sulphate, $\frac{1}{60}$ grain every third hour, were given. The tracings shown in Fig. 2 were taken on this date.

On December 25 there was a questionable syncope in the night, the pulse rate being 28 to 32. December 28 and 30 were spent in bed, there being vertigo when sitting up, but no faints. Tincture of digitalis was stopped. The tracings shown in Fig. 3 were made.

On January 4, 1909, the pulse rate was 26 to 32. There was dyspnœa, the apical systolic murmur was more pronounced, the liver moderately enlarged, and slight œdema of the legs was present. On January 13 the patient was more comfortable. The œdema had disappeared. The tracings shown in Fig. 4 were made.

During the next two weeks tincture of digitalis, 10 minims three times a day, was given and the pulse rate rose from 25, on January 15, to 34 on the 27th, and 40 on the 29th, when the drug was stopped. Atropine given in quantity sufficient to produce dryness of the throat and flushing caused no change in the pulse. On January 27 there was a slight epileptiform convulsion, during which the pulse was 34. The tracings shown in Fig. 5 were made about one hour later. On January 29, the tracings, shown in Fig. 6, were made.

On February 6 there was complete syncope while automobiling. No change was observed in the pulse, the rate being 36 to 38. Faint intermediate sounds were noted. From February 16 to 27, tincture of digitalis, 10 minims three times a day, was given without influence upon the pulse rate. On March 4 the patient had been comfortable, except for restlessness and slight dyspnœa at night. No faints have occurred until this date, when there was a convulsion. The pulse rate has been 26 to 32 of late. On March 7 there was a severe convulsion with marked cyanosis at 10 A.M. The pulse, observed by the husband, was said to have been 110 during the attack. Ten minutes later it was 30. On March 9, nocturnal, paroxysmal pain with slight dyspnœa, suggesting anginal attacks, was a complaint. There was evident slow cardiac enfeeblement. The heart sounds were faint, the rate 31. The liver was enlarged and slightly tender. There was no œdema. On March 11 there was weakness and vertigo, the usual prodromal symptoms of an attack. Nitroglycerin, $\frac{1}{100}$ grain, taken immediately caused pain and throbbing in the head, but apparently aborted the paroxysm. The pulse rate was 39. On March 13 nitroglycerin taken several times for precordial distress gave in each instance complete relief, and the patient felt better and looked better than for three months. The pulse rate varied between 26 and 62. On walking, the rate rose from 38 to 45, again slowing after a short time. On March 20 the pulse rate varied between 30 and 72, the husband once volunteering the observation that it suddenly dropped from 72 to half this. The patient walked about without distress, and nitroglycerin always relieved unpleasant symptoms. The tracings shown in Fig. 7 were made. After exertion and after nitroglycerin these showed no change.

April 20. The patient has been going along without incident during the past month, excepting a slight faint on April 19. The pulse rate has been constantly between 27 and 32. Today there was a convulsion. At the start the pulse was 28, as previously; then very slow; then full and about 80; then 35, and the attack ceased. Later the pulse was again 28. On April 21 there was vertigo in the night.

April 28. The pulse rate has been between 25 and 28 and the patient has been comfortable until the last three days, when there has been epigastric distention and distress, insomnia, dyspnœa, moderate orthopnœa, but no faints. There are present signs of slight cardiac insufficiency, a little cyanosis, a more marked systolic murmur at the apex, the pulse of a lower tension than before, the liver edge four inches below the costal border, and slight œdema of the ankles. Tincture of digitalis, 10 minims three times a day, was ordered, and the patient left for the country, where she is continuing comfortably and without event.

October 25, 1909. The pulse rate during the summer has been constantly between 28 and 34, with no change in the general symptoms and with but one convulsion and two syncopal attacks. On October 1, 1909, the pulse rate suddenly became 80 and has since varied between 60 and 90, with disappearance of œdema, dyspnœa, and other evidence of cardiac difficulty. The patient can go up four flights of stairs without trouble, is walking unrestrictedly, and feels perfectly well.

Analysis of Tracings. These were made with a modified Mackenzie polygraph. This instrument in its original form proved so inefficient and time-consuming as to compel its abandonment had not certain changes been worked out. These are: (1) The addition of a screw adjustment to the radial receiving tambour, making possible delicate changes in pressure on the artery; (2) the introduction of outlet valves in the air transmission for the ready adjustment of air pressure. This was done by perforation of the receiving jugular cup, the hole being covered by the finger during use; and placing a T-tube with clip in the arterial transmission; and (3) the use of a very dilute solution of methylene blue, reducing viscosity and consequent friction of writing points to a minimum. At best, however, the instrument is far from satisfactory and scarcely to be recommended for routine use.

The tracings shown in Fig. 1, recorded December 7, 1908, show simultaneous radial and jugular tracings that at first glance might be thought normal. The auricular rate is 60, the ventricular also 60. There is a complete *a-v* association. Measurement of the *a-c* interval brings to light the first graphic suggestion of trouble in the His bundle. Here the conduction time is increased from the normal one-fifth of a second or less, to one-fourth or one-third second. This observation, together with the history of the case, confirmed

the diagnosis of Stokes-Adams syndrome before the more definite later evidence was obtained.

Fig. 2, recorded December 24, 1908, shows an auricular rate of 90, a ventricular rate of 30. The jugular tracing shows waves of the auricular type occurring at approximately regular intervals, every third wave being followed, with slightly delayed conduction, by a ventricular contraction—the picture being clearly that of a partial *a-v* dissociation with a rhythm of 3 to 1. Events within the

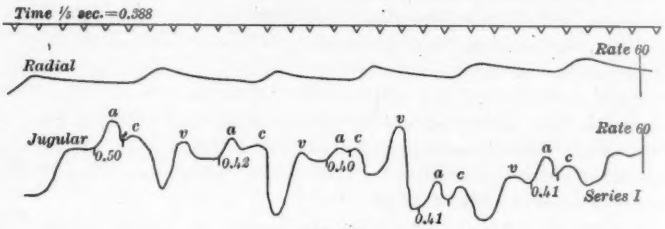

FIG. 1

ventricle may be followed by study of these groups of *a* waves. It is seen that the *a'* wave, that immediately succeeding ventricular systole, is followed by a marked negative wave due to the negative pressure in the empty and relaxing ventricle. The negative phase of the *a''* wave is less pronounced, thus illustrating the accumulation of blood in the inactive ventricle.

Fig. 3 shows an auricular rate of 90, a ventricular of 23, a complete *a-v* dissociation. This tracing is of interest in showing the interrelation of the *a* and *c* curves when there is independence of

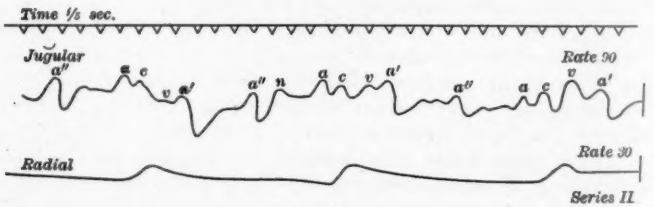

FIG. 2

auricle and ventricle. The curve (1) of broad summit can only be due to the close following of the *a* wave upon the *c*. Measurement of the auricular intervals shows this to be the case. Following the next *c* wave (2) is the *a* wave, high because of the resistance of the still contracting ventricle, and followed by a marked negative wave at the conclusion of ventricular systole and synchronous, therefore, with the dicrotic notch on the carotid tracing. The third *c* wave is very small and hardly differentiated from the *a* wave

immediately preceding. The auricular contraction has started a current of blood through the auriculoventricular orifice. This is met by a counter impulse arising from the slightly later ventricular contraction, and the resultant of these two forces is the lessened

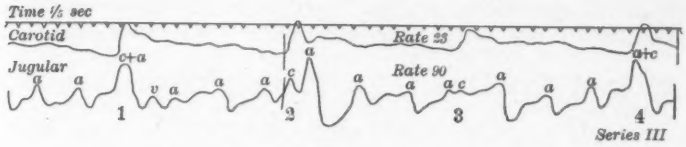

FIG. 3

c wave. The auricle, unable to discharge its contents fully, remains filled until the next *a* wave, when there is a prominent negative phase marking the egress into the relaxed ventricle.

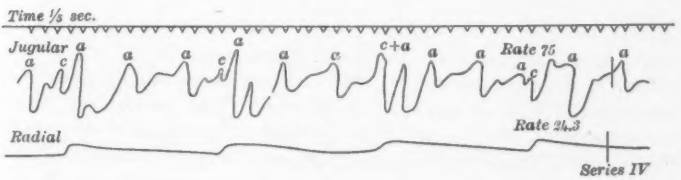

FIG. 4

Fig. 4, recorded January 13, 1909, shows an auricular rate of 75, a ventricular of 24.3, just missing a 3 to 1 rhythm, nevertheless a completely dissociated auricle and ventricle.

Fig. 5, recorded January 27, 1909, shows a condition similar to that of Fig. 4, the rate being more rapid—auricular, 90; ventricular, 29.

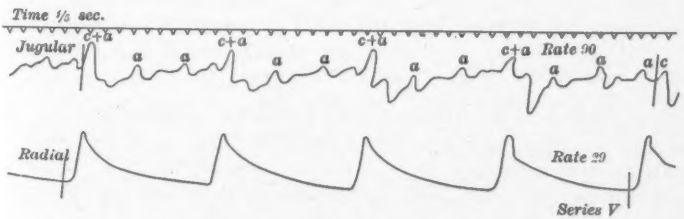

FIG. 5

Fig. 6, recorded January 29, 1909, shows an auricular rate of 93, a ventricular of 34, continued *a-v* dissociation. The series is distinguished by unusually prominent *n* waves. The *n* wave was first described by Erlanger and three possible factors in its causation

mentioned. These are: (1) A reflux wave from the auricle, due to the accumulation of blood within its chamber previous to auricular systole. This alone is an inadequate explanation, as such a wave could have no negative phase. (2) The occurrence of a presystolic wave in the great waves of the neck. (3) The reciprocal variation in pressure upon either side of the auriculo-ventricular valves during diastole caused by intermittent relaxation

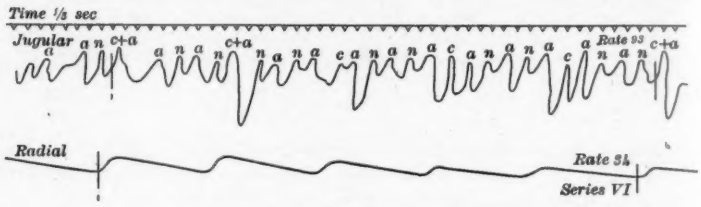

FIG. 6

of the ventricle. This gives rise to both positive and negative waves in the auricle and contributory great veins.[1]

Fig. 7, recorded March 20, 1909, shows an auricular rate, 78.3; ventricular, 39.15, an exact 2 to 1 rhythm. Such return to a partial *a-v* association after a prolonged period of completely dissociated auricle and ventricle is an argument against Nogoyo's statement[2] that complete *a-v* dissociation is proof of complete destruction of a segment of the His bundle, and therefore calls in question the accuracy

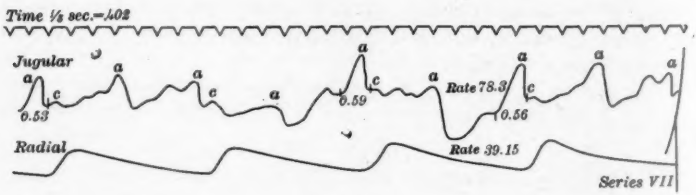

FIG. 7

of the division of the Stokes-Adams symptom complex into (1) the conduction type with complete dissociation and as a pathological basis, the complete division of the atrioventricular node, and (2) the muscle type, with only partial dissociation and the lesion a degenerative change in the heart muscle itself.

The tracings reproduced as Fig. 8 show complete *a-v* association with greatly delayed conduction. Such resumption of complete

[1] Von Frey and Krehl, Archiv f. Phys., 1890, xxxviii.

[2] Pathologisch-anatomische Beiträge zum Adams-Stokesschen Symptomkomplex, Ztschr. f. klin. Med., 1909, lxvii, 495.

a-v association after nine months of partial or complete *a-v* dissociation with disappearance of all symptoms is of special interest in considering the prognosis of heart-block.

Renewal of *a-v* association after a complete dissociation demonstrates, in so far as mere clinical observation can, that complete heart-block may exist without permanent solution of continuity of the atrioventricular bundle. That this effect was in this instance due to improved nutrition of the bundle through vasodilatation resulting from the action of nitroglycerin seems probable; and points to a sclerosis of the artery supplying this area as the most likely pathological basis of the case. This view is strengthened by benefit derived from digitalis whenever the heart muscle showed signs of failure. The improved nutrition of the bundle more than counterbalanced the usual evil effects of digitalis when there is impaired conductivity.

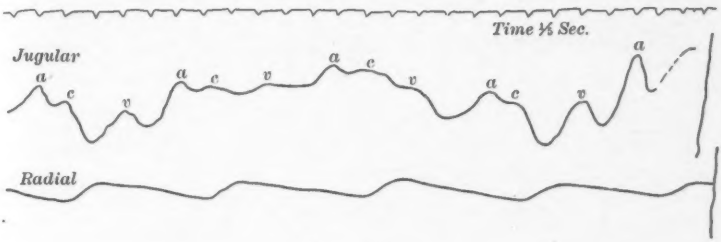

FIG. 8

CASE II.—*Heart-block with Stokes-Adams Syndrome.* The patient, a Jewish grocer, aged thirty years, is married, but has no children. He uses little alcohol, takes one cup of coffee, smokes seven cigarettes a day, and works long hours without out-of-door exercise. The past history includes scarlatina, measles, and probable pneumonia. There has been no serious illness since childhood, and no rheumatism or chorea.

The present illness goes back twelve years, at which time there were two or three syncopal attacks. These were repeated seven, five, and one year ago, and also two weeks before the present observation. These attacks have never been seen by a physician, but the patient says his face is at first flushed, then pale, and, as the paroxysm subsides, he feels his heart begin to beat hard. The trouble was first discovered six years ago, when his physician found an intermittent pulse, the rate 19 to 24, and the heart sounds at most 48. The patient considered himself perfectly well, and said his heart had been that way the past ten years. For a year and a half there has been œdema of the right leg. There has been no dyspnœa.

Physical Examination, January 3, 1908. The weight is 133½ pounds. The skin is rather pale, but the mucous membranes are of good color. The heart is moderately enlarged, the impulse one-half inch beyond the nipple line, and broad and lifting. No displacement by change of position is noted. There is a harsh apical and a slighter basic systolic murmur. The rate is 24, with occasionally an extrasystole. The arteries are slightly thickened. The arterial pressure is, systolic, 200; diastolic, 100. There are two or three jugular pulsations to each carotid. No auricular sounds can be heard. The right leg and thigh show tense œdema, probably from thrombosis of the femoral vein.

Later History—January 23, 1909. No faints have occurred during the past year. The heart is as before, except that no extrasystoles are made out. There are no intermediate sounds. The tracings (Fig. 9) were made on this date.

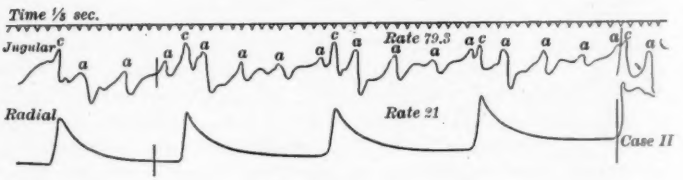

FIG. 9

Analysis of the Tracings. These show an auricular rate of 79.3; a ventricular of 21; a complete dissociation. However, the close approximation to a 4 to 1 rhythm is confusing, and a partial association in this ratio can be eliminated only by careful analysis. This close numerical relationship between auricular and ventricular rate in complete dissociation has several times come to my notice, and may easily be a source of error in the interpretation of a tracing. Figs. 4 and 5 of Case I, as well as the tracing from Case III (Fig. 10), also illustrate this point. The progressive diminution of the negative phase of each successive auricular wave occurring during a ventricular cycle, illustrating the degree of ventricular filling, is well shown. The history of bradycardia for sixteen years, of fainting attacks, beginning twelve years back, and continuing with remissions of one, two, four, and five years' duration, is unusual and gives peculiar interest to the future progress of the case.

CASE III.—*Heart-block without Stokes-Adams Syndrome.* The patient is a man, aged fifty-four years, a bookkeeper, whose father died at seventy-one of apoplexy. There is no history of alcoholism. He uses little tobacco or coffee, and was never ill until three and a half years ago.

Beginning three and a half years ago the patient suffered severe

abdominal pain after eating, became anemic, and six months later had severe melena. A stomach specialist diagnosticated duodenal ulcer from enteroptosis, and applied an abdominal belt, with relief of symptoms until December 8, 1908. At this time he began to suffer from epigastric pain and shortness of breath. His physician discovered a pulse of 35 and an enlarged liver, due to heart insufficiency. No one knows how long this bradycardia had existed, but it has been continuous since December 8, 1908; the rate varying between 33 and 41. With this has been dyspnœa and general incapacity for effort, so that the patient is carried upstairs. There has never been a single syncope or convulsion. Treatment with digitalis, convallaria, and strychnine has been without effect.

Physical Examination, March 2, 1909. The weight is 125¾ pounds, the height five feet two and one-half inches. There is pallor with slight cyanosis. The heart is somewhat enlarged downward and outward; the rate 34. The jugular vein shows a more frequent rhythm, judged to be about a 3 to 1, and apparently dissociated. There is no distinct heart murmur, but the first sound is

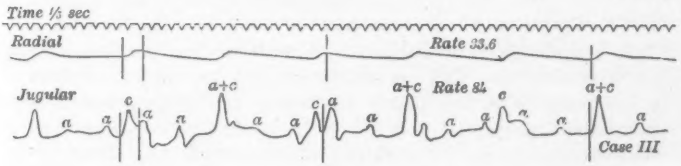

FIG. 10

low pitched and the second sounds are distant. The arteries do not seem thickened. The arterial pressure is, systolic, 240; diastolic, 110. The lungs are clear. The abdomen shows nothing abnormal. The liver is not enlarged, nor is there œdema. The hemoglobin is 95 per cent. The tracings (Fig. 10) were made March 2.

Later History. April 27, 1909. The patient writes from the country that for several weeks the pulse had been 72, and he had been feeling perfectly well until the onset of hot weather, when his pulse rate again fell to 40 and he was less comfortable. It is reasonable to infer a renewal of *a-v* association with subsequent lapse into a condition of partial or complete dissociation. This may be considered a probable instance of the occasional temporary character of heart-block.

Analysis of Tracings. These show a very remarkable *a-v* "dissociated association," the parallel of which we have yet to discover. The auricular rate is 84, the ventricular, 33.6; or an exact 5 to 2 rhythm. Furthermore, each alternate ventricular contraction is coincident with an auricular. This fact obtains throughout all the considerable length of tracings made, and so cannot be regarded

as a mere accident of the moment. Such a phenomenon suggests the possibility of a rhythmic *a-v* association of a type not yet worked out and one the existence of which must be established by further observations before its etiology can be taken into account.

The prolonged condition of bradycardia and heart-block without convulsions or faints is the feature of Case III most deserving of emphasis.

I gratefully acknowledge the assistance of Dr. Theodore C. Janeway at every part of this study: in supplying the clinical material and polygraph, in the labor of recording the tracings, and in the many valuable suggestions he has given.

THE PHYSIOLOGY AND PATHOLOGY OF CREATININE AND CREATINE.

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Our knowledge of creatinine and creatine has reached a point where a résumé can with advantage be given to the clinician, and it is the purpose of this paper to present briefly the present conception of this subject.

With the appearance, in 1904, of the Folin[1] method for the accurate determination of both creatinine and creatine the investigation of the relation of these two bodies to metabolism received a great impetus. In his lecture on "Chemical Problems in Hospital Practice," delivered before the Harvey Society nearly two years ago, Professor Folin[2] made this statement: "I venture to predict that we shall learn more concerning the abnormal or subnormal metabolism of the sick on the basis of creatinine and creatine determinations alone than could be learned in another thirty years by means of the nitrogen determinations of the past." The importance and widespread interest in this question is again exemplified by the admirable paper of Professor Mendel,[3] given in the symposium on this subject before the various allied societies at their annual meeting in Baltimore last year.

The Physiological Elimination of Creatinine. Folin[4] was the first investigator to point out that the amount of creatinine excreted in the urine by a normal individual is quite independent of either the amount of protein in the food or of the total nitrogen

[1] Ztschr. f. phys. Chem., 1904, xli, 233.
[2] Jour. Amer. Med. Assoc., 1908, l, 1391.
[3] Science, 1909, xxix, 584.
[4] Amer. Jour. Phys., 1905, xiii, 46. See also Amer. Jour. Insan., 1904, lx, 699, and lxi, 299.

in the urine, the amount excreted from day to day being practically constant for each individual (presumably in the same physical condition). The constancy of this creatinine excretion has been fully confirmed by van Hoogenhuyze and Verploegh,[5] Klercker,[6] Closson,[7] and Shaffer.[8] Shaffer[9] has further observed just as great uniformity in the hourly excretion of creatinine as is found in the daily excretion. Even very great diuresis has no effect on this hourly elimination. A great increase or decrease in the amount of protein ingested at a single meal, resulting in marked change in the amount of total nitrogen excreted per hour, is also without effect upon the hourly excretion of creatinine. Furthermore, experiments by both van Hoogenhuyze and Verploegh,[10] and Shaffer have shown that neither increased nor decreased muscular activity uncomplicated by other factors has any effect upon the creatinine elimination. Such results indicate that the regularity of excretion of creatinine is to be explained by a regularity of formation, and not merely by a regular kidney secretion.

While the creatinine excretion is practically constant from day to day for each healthy individual, different persons excrete different amounts, and Folin pointed out that "the chief factor determining the amount of creatinine eliminated appears to be the weight of the person." He further noted that the fatter the subject, the less creatinine is excreted per kilo of body weight and concluded from this that the amount of creatinine excreted depends primarily upon the mass of active protoplasmic tissue. This, however, is not the only factor of influence, and on account of the complexity of the subject it is difficult to point out the factors involved. This question was discussed at length by Benedict and me[11] from the study of a large number of cases in the Connecticut Hospital for the Insane. In the case of women, the same investigators found that the creatinine excreted was, in general, much lower than that of men, doubtless due to their poorer muscular development. Here the creatinine-forming process is less active, and there is, at the same time, a lower muscular efficiency.

The significant physiological fact to be borne in mind in regard to creatinine is the absolute constancy of its elimination, different for different individuals, but wholly independent of quantitative changes in the amount of nitrogen excreted, thus pointing conclusively to its endogenous origin. As Folin has indicated, creatinine is by far the most reliable index as to the amount of a certain kind of true tissue katabolism occurring daily in any given individual. It has been found convenient to express the daily creatinine elimina-

[5] Ztschr. f. phys. Chem., 1905, xlvi, 415.
[6] Beitr. z. chem. Phys. u. Path., 1906, viii, 59.
[7] Amer. Jour. Phys., 1906, xvi, 252.
[8] Ibid., 1908, xxiii, 1.
[9] Ibid., 1908, xxii, 445.
[10] Ztschr. f. phys. Chem., 1908, lviii, 161.
[11] Amer. Jour. Phys., 1907, xviii, 377.

tion in milligrams of creatinine nitrogen per kilo of body weight, and this has been called the creatinine co-efficient. For a strictly normal individual, this co-efficient is between 7 and 11 milligrams of creatinine-nitrogen.

THE ELIMINATION OF CREATININE IN PATHOLOGICAL CONDITIONS. That the creatinine elimination is affected by different pathological conditions has been shown by a number of investigators. In general, it may be stated that fevers produce an increase in its elimination, while a decrease is observed in a large number of other pathological states.

The effect of fever on the creatinine output has been studied by Leathes,[12] van Hoogenhuyze and Verploegh, Shaffer, and Klercker.[13] The rise in body temperature was found to be accompanied by an increased creatinine elimination. Van Hoogenhuyze and Verploegh noted the maximum creatinine excretion at the same time, or within a few hours of the highest temperature. In a study of such fevers as pneumonia, erysipelas, and typhoid, Klercker observed that during a long course of fever the height of the creatinine elimination decreases and may finally become considerably subnormal. After a short course of fever an increase may be found even during convalescence.

In an extended study of seven insane patients, van Hoogenhuyze and Verploegh observed variations in the creatinine elimination during periods of exultation and depression, there being an increase during the former and a decrease during the latter. They also observed an increase under the effects of stimulation with alcohol, syrup of cola, and strychnine, and a decrease following potassium bromide and absolute rest.

A low creatinine elimination has been found associated with a large number of abnormal conditions, especially those accompanied by muscular weakness. Benedict and I observed a creatinine co-efficient as low as 2 in two very old, decrepit women. In very young infants, Amberg and Morrill[14] found the co-efficient between 1.5 and 2.6, figures which one would expect from the small bulk of of muscular tissue. Funaro[15] obtained similar results.

In patients suffering from exophthalmic goitre Shaffer observed a very low excretion of creatinine, even though the total endogenous metabolism was above the normal, as shown by a rapid loss of weight and by emaciation. He concluded that creatinine was not a product of total tissue katabolism, but rather of certain normal cell processes, which in many diseased conditions may be extremely sluggish in their intensity. Forschbach[16] likewise observed a low creatinine output in cases of exophthalmic goitre. In two cases of myelogenous leukemia this author noted a low creatinine elimina-

[12] Jour. Phys., 1907, xxxv, 205.
[13] Ztschr. f. klin. Med., 1909, lxviii, 22.
[14] Jour. Biol. Chem., 1907, iii, 311.
[15] Biochem. Ztschr., 1908, x, 467.
[16] Arch. f. exp. Path. u. Pharm., 1907, lviii, 112.

tion, and in one case of lymphatic leukemia Shaffer reported a similar result. Mellanby[17] has recorded a diminished elimination of creatinine in disease of the liver, especially carcinoma.

Spriggs[18] reported a very low creatinine excretion in two cases of muscular dystrophy (co-efficients 2.2 and 4.0), and in one case of amytonia congenita (co-efficient 1.9). He has also observed a much diminished elimination of creatinine in a case of pseudo-hypertrophic muscular dystrophy.[19] Levene and Kristeller[20] found very low creatinine co-efficients in four cases of muscular dystrophy, the co-efficient obtained from the average of six observations on one patient, aged seventeen years, being 1.5.

The effect of fasting on the creatinine elimination has been studied by van Hoogenhuyze and Verploegh, Benedict,[21] Benedict and Diefendorf,[22] and Cathcart.[23] In general, a moderate diminution in the creatinine has been noted during the progress of the fast. Similar results have been obtained on animals by Underhill and Kleiner[24] and also in experiments by Mendel and me.[25]

Changes have been noted in the creatinine elimination of experimental animals under the influence of various poisons, especially those which tend to produce a degeneration of liver tissue, such as potassium cyanide, hydrazine, phosphorus, amyl alcohol, and chromates. Such experiments have been performed by Loewy, Wolf and Osterberg,[26] Richards and Wallace,[27] Underhill and Kleiner, Lusk,[28] and Lefmann.[29]

Creatinine in Muscle. The recent papers of Grindley and Woods,[30] Mellanby, and Mendel and Leavenworth[31] appear conclusive that creatinine is not present preformed in the muscular tissue and hence our consideration of this compound is wholly confined to its elimination in the urine.

The Elimination of Creatine. In his original discussion of the subject Folin pointed out that although creatine is normally absent from urine, occasionally small amounts can be found. Benedict first noted that during inanition (experiments on a professional faster) considerable quantities of creatine appear in the urine, and subsequently in collaboration with Diefendorf confirmed this on a fasting woman. Independently, Cathcart observed this elimination of creatine during inanition. In fasting experiments which he conducted on rabbits, Dorner[32] also noted the

[17] Jour. Phys., 1908, xxxvi, 447.
[18] Quart. Jour. Med., 1907, i, 63.
[19] Biochem. Jour., 1907, ii, 206.
[20] Amer. Jour. Phys., 1909, xxiv, 45.
[21] Carnegie Inst., Washington, 1907, Pub. No. 77, 386.
[22] Amer. Jour. Phys., 1907, xviii, 362.
[23] Jour. Phys., 1907, xxxv, 500; also Biochem. Ztschr., 1907, vi, 133.
[24] Jour. Biol. Chem., 1908, iv, 165.
[25] Unpublished results.
[26] Biochem. Ztschr., 1908, viii, 123.
[27] Jour. Biol. Chem., 1908, iv, 179.
[28] Amer. Jour. Phys., 1907, xix, 464.
[29] Ztschr. f. phys. Chem., 1908, lvii, 476.
[30] Jour. Biol. Chem., 1907, ii, 309.
[31] Amer. Jour. Phys., 1908, xxi, 100.
[32] Ztschr. f. phys. Chem., 1907, lii, 225.

appearance of creatine; while in similar experiments on dogs, Underhill and Kleiner, and Richards and Wallace obtained the same results. In an experiment made by Mendel and me on a fasting dog, it was found that after creatine had been continuously excreted for some time, it could be made to disappear by a practically pure carbohydrate diet.

Benedict and I[33] were the first workers to report the elimination of creatine in a large number of individuals. In general, the quantity found was not large, though in one case the amount of creatine was greater than creatinine. The presence of this creatine in these cases may, perhaps, be generally explained as due to malnutrition.

Both Mellanby and van Hoogenhuyze and Verploegh have reported observations on patients suffering with carcinoma of the liver. Here the creatine elimination is very high, often a gram and a half per day. The latter investigators have found creatine almost absent in carcinoma of the stomach, thus pointing to some probable lack of liver function in the first instance.

In two cases of diabetes, Shaffer reports a considerable elimination of creatine, but in a measure, at least, this finds explanation in the meat diet. I have noted the same result in several cases which I have had occasion to examine. Shaffer has reported a considerable elimination of creatine in exophthalmic goitre. During the postpartum resolution of the uterus in women he has observed a marked elimination of creatine. This has also been noted by Murlin[34] in dogs. A considerable elimination of creatine during typhoid fever has been reported by Shaffer, and from a study of fevers Klercker concludes that sooner or later after the onset of fever, creatine is eliminated, a condition which lasts for a longer or shorter time, often to convalescence. Levene and Kristeller report the elimination of creatine, especially in their cases of muscular dystrophy.

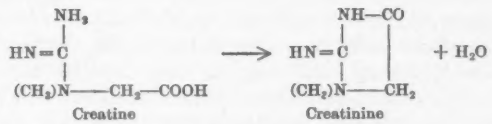
Loewy, Wolf, and Osterberg, and Richards and Wallace, in their work with potassium cyanide, found the creatine elimination in dogs to be increased. Underhill and Kleiner obtained the same results with hydrazine, and likewise Lefmann from chromate poisoning.

Creatine in Muscle. According to Urano,[35] muscle tissue contains about 0.4 per cent. of creatine, and from this it has been calculated that a man weighing 60 kilos would have from 90 to 100 grams of creatine stored up in his muscle. In this connection, it is of interest that, according to Urano, the creatine of the muscle appears to be held in some non-diffusible form in the contractile tissue, and is only released when the integrity of the muscle

[33] Amer. Jour. Phys., 1907, xviii, 407.
[34] Ibid., 1909, xxiii, xxxi.
[35] Beitr. z. chem. Phys. u. Pathol., 1907, ix, 104.

bundle is impaired. The experiments of Mellanby indicate that the performance of muscular work leaves the creatine unaffected. Saiki[36] has demonstrated the presence of creatine in non-striated mammalian muscle, though here the quantity is much smaller, less than 0.1 per cent. It is not found, however, in invertebrate muscle.

RELATIONSHIP BETWEEN CREATININE AND CREATINE. Since creatine can be easily converted into creatinine under the hydrolytic action of weak acids, it was quite logical for the physiologist to assume some genetic relation between these compounds in the living body.



From this point of view, creatine was looked upon as a product of protein metabolism in muscle, easily converted into the "anhydride" creatinine and thus eliminated in the urine. However, the attempt to connect the excreted creatinine with tissue creatine brought to light an apparent independence of these compounds in metabolism. Ingestion of creatinine results in an increased creatinine elimination, but when creatine is fed to man or animals Folin,[37] Klercker,[38] van Hoogenhuyze and Verploegh, and Lefmann have all found that the creatinine content of the urine is only slightly altered if at all; nor is the creatine itself eliminated. Observations by Lefmann also uphold this for creatine introduced parenterally. The fact that ingested creatine is apparently not changed to creatinine in the body, together with the appearance of creatine in the urine during inanition and also certain other pathological conditions, led Folin, Benedict, and Klercker to question any biological relationship between these two compounds. The unique appearance of creatine under these circumstances must be borne in mind whenever this substance is found accompanying abnormal conditions attended by inadequate nutrition. In practically every such case it is reasonable to ascribe the source to the creatine of the muscle. As was stated above, creatine is excreted in acute fevers and various manifestations in which there is a rapid loss of muscle proteins. The creatine elimination is likewise marked in the urine of women during the first week post partum, when resolution of the uterus is taking place. However, in the majority of the conditions in which creatine is eliminated the creatinine excretion is abnormal and, as a rule, subnormal. This seems to be especially noteworthy in cases of muscular dystrophy and carcinoma of the liver. The evidence

[36] Jour. Biol. Chem., 1908, iv, 483.
[37] Festschrift f. Olof Hammarsten, 1906, III.
[38] Biochem. Ztschr., 1907, iii, 43.

presented by Mellanby, van Hoogenhuyze and Verploegh, and Lefmann, all point to a possible liver function in creatine and creatinine metabolism.

By an elaborate investigation of the behavior of these compounds during autolysis, Gottlieb and Stangassinger[39] have concluded that they can undergo a series of enzymatic transformations in the body, the more important of which are that, creatine can be formed in the autolysis of muscles and other organs, that preformed or added creatine can be converted by enzymatic means into creatinine during autolysis, and further, that both of these compounds may be destroyed by appropriate enzymes, creatase and creatinase. This was disputed by Mellanby, but after a repetition of the above work van Hoogenhuyze and Verploegh, Rothmann,[40] and Lefmann, all maintain the essential importance of endo-enzymes in the metabolism of the compounds under discussion. Such being the case, the liver is very probably the organ in the body most concerned in this action, especially in the formation of creatinine. Furthermore, it may be that when the tissues are drawn upon for supplies, as in hunger or cachexia, the creatine liberated by the disintegrating muscle now escapes destruction, owing to the lowered efficiency of some katabolic organ, such as the liver, and is eliminated as such.

At the present time it is impossible to formulate any hypothesis of creatine and creatinine metabolism which will correspond with all the data at hand. Creatinine is, however, very evidently a product of normal katabolism, possibly of muscle tissue. It is formed as the result of certain normal cell processes and is an index of the amount of a certain kind of true tissue metabolism. Creatine, on the other hand, is formed as the result of certain abnormal processes, and is, perhaps, an index of the amount of protein destruction. In one case the creatinine is apparently the result of the ordinary wear and tear, while in the other conditions, in which the protein is used to supply abnormal demands made upon it (energy, etc.), creatine is liberated by the disintegrating tissue. The experiments of Mendel and myself, in which carbohydrate was found to cause the urinary creatine of a fasting dog to disappear, harmonizes with this view. This hypothesis would explain why, in pathological cases, the total creatinine (creatinine + creatine) is not constant, though generally in the cases in which creatine is eliminated creatinine is diminished. (In fevers, the creatinine elimination is increased, due possibly to the high temperature.) Flesh destruction may be rapid, as in advanced carcinoma of the liver. In the tissues where this abnormal katabolism is taking place, creatine would result, while creatinine would be formed by the tissues

[39] Ztschr. f. physiol. Chem., 1907, lii, 1; ibid., 1908, lv, 322; and Stangassinger, ibid., 1908, lv, 295.

[40] Ibid., 1908, lvii, 131.

which were functionating normally. If the tissue destruction were great, the creatinine would necessarily be low, and, on the other hand, the creatine would be high with a high total. According to the above idea creatinine and creatine would be two phases in the katabolism of some one substance, the one a product of normal katabolism, the other of abnormal katabolism.

Many objections can be offered to such an hypothesis as the foregoing, but nevertheless it corresponds with much of the data at hand, and furthermore, aids in the interpretation of the results from a clinical standpoint.

THE METHOD OF DETERMINING CREATININE AND CREATINE. Inasmuch as the impetus for the recent work on creatinine and creatine has been due to the development of a satisfactory method for their accurate determination by Folin, a few statements can with advantage be made in regard to the method. This method is based upon the characteristic property possessed by creatinine of yielding a certain definite color reaction with picric acid in alkaline solution, the Jaffé color test. When properly diluted, the color corresponds almost exactly with $\frac{N}{2}$ potassium bichromate solution which is used as a standard. By means of a good colorimeter, such as the Duboscq, the quantity of creatinine can be estimated with great accuracy. For the determination of creatine, Folin originally recommended heating 10 c.c. of urine with an equal volume of normal hydrochloric acid on the water bath for three hours to convert any creatine to creatinine. The colorometric estimation would then give the total creatinine, and by subtracting the preformed creatinine from the total, the creatine would be obtained in terms of creatinine. While working with Benedict,[41] I found that this hydrolytic action by which the creatine was changed to creatinine could be completed in one-half hour in an autoclave at 117° to 120° C., and this is the method of conversion now generally employed.

SUMMARY. The significant physiological fact to be borne in mind in regard to creatinine, is the absolute constancy of its elimination, different for different individuals, but wholly independent of the volume of the urine and the amount of nitrogen excreted. Creatinine is an index of some special process of normal metabolism taking place largely, if not entirely, in the muscles. The intensity of this process appears to be associated with the muscular strength of the individual. In pathological conditions, the creatinine excretion is usually low. From this point of view, the creatinine output may be looked upon, at least to a certain extent, as an index of the physical condition of the patient. The creatinine elimination appears to be especially low in conditions associated with muscular weakness or inefficiency. It is, however, slightly increased in acute fevers and here does not run parallel with the muscular strength.

[41] Amer. Jour. Phys., 1907, xviii, 397.

In diseases in which the creatinine output is low, creatine is generally excreted. Creatine is not normally present in the urine, and its excretion may be regarded as pathological. Furthermore, it is usually found to be associated with a loss of muscle protein, thus indicating that the source of the endogenous urinary creatine is the creatine of muscle tissue.

A SKIN REACTION IN CARCINOMA FROM THE SUBCUTANEOUS INJECTION OF HUMAN RED BLOOD CELLS.

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Clinical and experimental investigations have shown that in the growth and breaking down of malignant tumors substances are formed and set free which are very poisonous to the red cells of the blood, and which probably cause the anemia and cachexia of malignant disease. Although the nature of most of these poisonous substances has not yet been determined, some of them are known to belong to the class of lysins.

The knowledge that extracts of malignant tumors have marked hemolytic qualities naturally led to the search for hemolysins in the serum of animals and of man affected with malignant disease. If the blood serum of patients suffering from malignant disease contained hemolysins, while that of normal individuals or of those suffering from other diseases did not, then we would have at our command a method of value for the diagnosis of malignant disease. Crile, Weil, Pesskind, Blumgarten, Epstein and Ottenberg, Kelling, Kullman, and many others have made studies of the blood serum of patients, in order to determine whether there was anything characteristic in the blood of individuals with carcinoma. Crile claimed that in the early stages of carcinoma the blood serum was markedly hemolytic, and that as the disease advanced, the hemolytic properties of the serum disappeared. The other investigators substantiated Crile's claim that a number of the serums from carcinoma patients possessed hemolytic qualities, but they were able to find hemolytic serums only in a much smaller percentage of patients than did the first-named investigator. All agree that hemolysins for human red blood cells are present in 50 to 60 per cent. of the patients, although hemolysins exist in the serum of many other dis-

eased individuals. The hope that the hemolytic test might prove of clinical value in the diagnosis of carcinoma has thus far been proved futile.

Weil, who was one of the earliest to investigate the subject, and who has published careful and critical studies of hemolysis in malignant disease, comes to the conclusion that it is possible that "something of value may eventually come of the use of this method in human disease, but that it will have to come with a refinement of method which will correspond to the complexity of the factors involved."

The hemolytic tests are made by mixing the serum of the patient with stated quantities of suspensions of washed human red blood cells from normal individuals. The tubes are kept in the thermostat for a number of hours, and the presence or absence of hemolysis is determined by the appearance of the supernatant fluid after the red cells have settled. If hemolysis has taken place, the fluid is colored pink or red by the hemoglobin which has been set free. By this method, the degree and presence of hemolysis is determined by the amount of laking of the red cells. The hemoglobin is therefore the indicator. The test-tube reaction gives no evidence of other substances which have been liberated. A small amount of hemolysin in the serum that is being tested may be insufficient to hemolyze enough cells to produce a coloration of the supernatant fluid appreciable to the eye.

It occurred to one of us[1] that it might be possible to gain a better knowledge of the hemolytic properties of the serum of human beings with malignant disease if red cells from a normal individual were brought into contact with the serum of patients *in vivo*—that is if the cells were injected under the skin of the patients.

Theoretically there might be certain advantages in such a method. If normal red blood cells are injected under the skin of a patient whose serum is hemolytic, fresh quantities of hemolysin would be continually brought to the cells by the circulating blood and lymph, and therefore—even if the amount of the hemolysin in the blood of the patient was very small—the injected cells might nevertheless be hemolyzed. Every organic substance which was liberated by the destruction of the injected red cells would enter the tissues and there have its effect. The hemoglobin and other substances which had been set free might cause a local change in the tissues at the site of the in ection. If blood cells are injected under the skin of a normal individual, they are broken up and carried off by the body cells and fluids; the condition of affairs under the skin of a patient whose blood serum contains free hemolysins would be an entirely different one because a different process was taking place.

These theoretical considerations led one of us[2] to suggest that

[1] Elsberg, Jour. Amer. Med. Assoc., March 27, 1909. [2] Ibid.

injections of washed human red blood cells from normal individuals should be made under the skin of normal and of diseased individuals, in order to determine whether a local reaction was produced, and if so, if there was anything characteristic in the appearance of the skin at the site of the injection in patients who suffered from carcinoma. As we shall report in what follows, a decided local reaction was observed in a large percentage of the patients with malignant disease, while no reaction was observed in a large percentage of normal individuals or of those with other diseases.

TECHNIQUE. The blood is obtained in the following manner: Into an ordinary aspirating syringe of 10 to 15 c.c. capacity a glass bead about the size of a split pea is placed, and the syringe and needle are boiled in normal saline solution. The anterior aspect of the elbow of the individual whose vein is to be aspirated is carefully cleaned with soap and water, alcohol and ether, and a vein made prominent by tying a bandage around the arm. Under proper aseptic precautions the vein is punctured and 5 to 10 c.c. of blood is aspirated into the cooled syringe. The needle is then removed from the syringe, the end of the latter covered with a piece of sterile gauze, and the syringe shaken for ten minutes. After the blood has been defibrinated in this manner, about 1 c.c. is expressed into each of a number of sterile test-tubes that fit into an ordinary centrifuge, and that have been previously half filled with sterile normal salt solution. The usual bacteriological technique (passing the ends of the test-tubes through the flame, etc.) is employed to keep the contents of the tubes sterile.[3] The tubes are now placed in the centrifuge for ten minutes. The clear supernatant fluid is then carefully poured off from each tube under the proper precautions to prevent infection. Fresh sterile salt solution is added, the tubes are gently shaken to mix the blood with the solution, and the tubes are again centrifuged for ten minutes. The same process is repeated a third time. Then, after the supernatant fluid has been poured off, four times as much salt solution as there are cells by volume is added. Thus, approximately, a 20 per cent. suspension of washed red blood cells has been obtained. The tubes are kept in the ice chest for 24 to 48 hours, and are then ready for use. Any tubes in which there is the slightest amount of laking must not be used. If careful technique has been employed, the red cell suspension will often be free from laking for three or four days.[4]

It is important to select the proper individual from whom the blood is to be obtained. Tuberculosis and syphilis must be excluded, the patient must not only be free from any evidence of disease, but must not have been recently ill, nor have received any injury, must not have had even the slightest operation, and must not have

[3] In our entire series there was not a single case of infection. Cultures were made from a number of the tubes; they were always found to be sterile.

[4] We have been unable to keep the suspension free from laking for more than five days.

FIG. 1.—The skin lesion in a patient with carcinoma of the stomach eight hours after the injection.

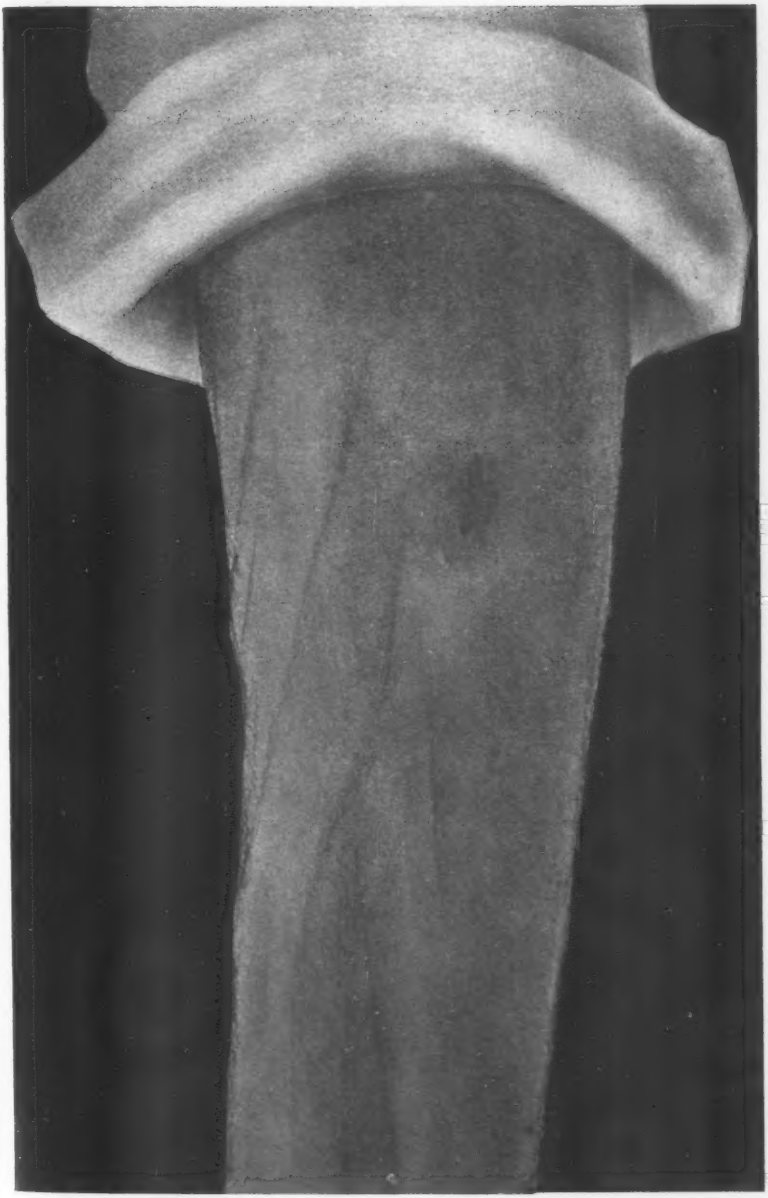

FIG. 2.—The skin lesion in a patient with carcinoma of the breast about seven hours after the injection.

recently had an anesthetic. The blood of individuals who have had any of these conditions is unfit for injection purposes. The blood can, however, be taken from a patient during the early stages of ether anesthesia. We have found that the most satisfactory blood is that obtained from small children, and in the hospital we have usually obtained it from little patients who were to be operated upon for hernia.

We have given injections of the blood of animals whose cells are known to be resistant to hemolysis by normal human serum, but the results obtained were not satisfactory. We have also made injections of mixed cells from several individuals, but we soon found that there was no advantage to be gained from blood mixtures. We have, finally, used suspensions of various strengths for injection purposes, but we have found that the 20 per cent. suspension gave the best results.

The Method of Injection. A hypodermic syringe which has been boiled in normal saline solution and cooled is filled with the blood mixture. For this purpose the tube which contains the blood is thoroughly shaken, and some of the mixture is poured into a watch crystal which has been sterilized by boiling in normal salt solution. From this watch crystal the blood is drawn up into the syringe. The skin on the anterior aspect of the forearm of the patient is cleansed with alcohol, and 5 minims of the suspension is injected in an upward direction under the skin, at a spot where there are no visible veins. The injection raises the skin, but the elevation disappears after a few minutes. The injection is not painful, and requires but a moment. Care must be taken that the blood is injected under and not into the skin.[5]

THE REACTION. The reaction begins to show itself in about five hours after the injection; it gradually increases in intensity until it has reached its height in six to eight hours. It may appear sooner than the time stated, even as early as two hours after the injection, or may require eight hours before it becomes evident. When fully developed, the reaction appears as a somewhat irregular oval area with a well-defined margin measuring from 1 x 2 to 3 x 5 cm. The margin is often surrounded by a whitish areola. The color of the lesion varies from a brownish red to a maroon, with, rarely, a bluish tinge (Figs. 1 and 2). The lesion is distinctly raised from the surrounding skin surface. At times this elevation is so slight that careful examination in good daylight is necessary to recognize it. The raised area has a slightly boggy feeling, as if there were a subcutaneous exudation, and it is often somewhat tender.[6]

[5] Some intracutaneous and cutaneous tests were attempted after the method of von Pirquet, but without success.

[6] Up to the present time only three specimens of skin from patients who presented the characteristic lesion have been examined microscopically. We have to thank Dr. Mandlebaum, director of the Pathological Laboratory of Mt. Sinai Hospital, and Dr. Buerger,

The lesion may appear slowly or rapidly, it may remain stationary for several hours, and fade quickly or gradually. Sometimes it has entirely disappeared six hours after the injection, at other times it begins to fade only after ten to twelve hours. When the lesion has disappeared, there remains behind a flat yellowish or greenish discoloration such as is left by any small ecchymosis (Fig. 3). In those cases in which the characteristic lesion does not appear the skin either presents no change except the needle puncture, or a small flat area of varying color; rarely, the skin is raised, but of normal color. The typical color and elevation being best seen in daylight, it is advisable to make the injection in the morning. We have usually given the injections between nine and ten in the morning and have completed our observations at six in the evening.

RESULTS. Up to the present time we have given 684 injections to 432 patients. For purposes of classification, we have divided the cases into the following groups (see Table I):

1. *Patients with carcinoma*, in whom the diagnosis was positive as proved by operation, autopsy, pathological examination; and patients in whom the diagnosis of malignant disease was rendered very probable by the presence of a tumor and the other symptoms which are charactetistic of cancer.

2. *Patients in whom the absence of malignant disease was certain.* Among these were individuals suffering from every variety of acute and chronic disease that is to be met with in a large general hospital. Among the diseases may be mentioned acute and chronic inflammatory diseases, such as pneumonia, typhoid fever, nephritis, appendicitis, cholecystitis, osteomyelitis, abscesses, tuberculosis, syphilis, pernicious anemia, leukemia, Hodgkin's disease, myeloma, glanders, benign newgrowths, acute and chronic diseases of children, etc. In this connection it is but fair to mention that some of the patients who were treated at the hospital and discharged with other diagnoses may have nevertheless suffered from malignant disease which gave no symptoms while the patients were under observation.

3. *Possible Carcinoma.* Patients in whom malignant disease was suspected but in whom no positive diagnosis could be made before the patients left the hospital.

4. *Very Advanced and Miliary Carcinoma.* Cachectic and anemic individuals with metastases and generalized malignant disease, in the last stages of carcinoma.

associate in surgical pathology, for the preparation and examination of the specimens. A large number of specimens with the proper controls will be examined and reported on in the future. It may be of interest, however, to quote the following from Dr. Buerger's report: "In a general way it may be said that the individual pictures have little in common. Specimen I shows an acute inflammatory process with marked exudation of polynuclear leukocytes" (lésion was 24 hours old); "specimen II is characterized by dissolution and disappearance of red blood cells" (8 hours old); "specimen III must be regarded as difficult of interpretation, because the hemorrhage below the skin could be considered either as injected blood or as blood extravasation due to removal of the specimen."

FIG. 3.—The greenish discoloration (ecchymosis) twenty-four hours after the lesion had disappeared. The patient had a carcinoma of the thyroid gland.

TABLE I.

	No. of cases.	Positive reactions.	Negative reactions.	Doubtful reactions.[7]
Carcinoma, positive or probable	69	62 = 89.9%	5 = 7.2%	2 = 2.9%
No carcinoma	325	15 = 4.6%	307 = 94.3%	3 = 1.1%
Possible carcinoma	9	7 = 77.8%	2 = 22.2%	.....
Carcinoma, advanced or miliary	11	.....	11 = 100%	.....

Table I shows that a positive skin reaction was observed in 90 per cent. of the patients with carcinoma (excepting the very advanced), and that there was no reaction in 94 per cent. of the patients who were suffering from other diseases. Of the patients in whom carcinoma was suspected but could not be proved, 78 per cent. gave a positive reaction. In all of the patients with advanced malignant disease, with metastatic deposits in the various viscera or miliary carcinoma, etc., no skin reaction was observed after the injections.[8]

TABLE II.

Carcinoma of	No. of cases.	Positive reaction.	Negative or doubtful reaction.
Lip, palate, tongue	3	3	0
Neck	1	1	0
Œsophagus	5	3	2
Stomach	22	21	1
Liver	2	1	1
Large and small intestine	2	2	0
Rectum	5	4	1
Abdomen	5	3	2
Abdomen, metastatic tumor	3	1	2
Abdomen, miliary or multiple metastases.	7	0	7
Pancreas[9]	1	0	1
Thyroid	2	2	0
Mediastinum	3	3	0
Lung	1	1	0
Breast	6	6	0
Bladder	3	3	0
Prostate	2	2	0
Uterus	4	4	0
Vagina	1	1	0
Skin	1	1	0
Spine, metastatic tumor	1	0	1

[7] These are reactions that resemble in appearance the type reaction, but not closely enough to call them definitely positive.

[8] We have tested patients with sarcomatous disease, but the number thus far examined has been small. Of seven patients with sarcoma, four gave a positive reaction. Of three cases of hypernephroma, one gave a positive reaction.

[9] Postmortem examination revealed one microscopic nest of carcinoma.

Table II gives a list of all the patients with carcinoma to whom blood injections were given, and the results obtained. In some of the patients positive reactions were obtained after the first and no skin reactions after later injections. In a small number of patients the first injection gave negative, and later injections with other blood suspensions gave positive reactions.

In the following list are the synopses of the histories of patients with no malignant disease in whom a positive reaction was obtained. The symptoms and diagnoses are abstracted from the hospital records:

Case I.—M. C., aged sixteen years; congenital growing lymphangiomas and hemangiomas of the groin and extremities. First injection, given after removal of one of the tumors, positive; four following injections, negative.

Case II.—E. J., aged forty years; gastric history of one year's duration with loss of flesh and strength. Laparotomy failed to show carcinoma or any other lesion. Four injections, all positive.

Case III.—M. J., aged forty years; parenchymatous and cystic goitre.

Case IV.—A. S., aged forty years; double parotid tumors improved under syphilitic treatment, enlarged right kidney.

Case V.—A. H., aged seventy years; enlarged prostate, cystitis, emaciation. Postmortem examination revealed generalized miliary tuberculosis. One injection positive; three negative.

Case VI.—J. A., aged forty-six years; myxoma of the shoulder, enlarged glands in the axilla not removed.

Case VII.—B. A., aged fifty years; subphrenic abscess of unknown origin; one positive, one negative reaction.

Case VIII.—M. B., aged forty years; arteriosclerosis, bloody fluid in the pleuræ, icterus; discharged improved; medical treatment.

Case IX.—I. L., aged forty-five years; emaciated; gastric symptoms; improved under treatment; diagnosis on discharge from the medical wards was gastric ulcer.

Case X.—J. G., aged seventy years; hematemesis, emaciation, anemia. Death from repeated hemorrhages. At the postmortem examination, large pyloric ulcer.

Case XI.—S. S., aged thirty-five years; emphysema and bronchitis, obscure gastric symptoms.

Case XII.—Age unknown, discharged after a short stay in the hospital with a diagnosis of chronic appendicitis. Unfortunately, the chart of this patient can not be found.

Case XIII.—F. P., age unknown; pyosalpinx, pneumonia.

Case XIV.—V. A., aged forty-four years; incipient Basedow's disease, neurasthenia.

Case XV.—V. L., aged fifty years; progressive anemia, sudden death.

General anesthesia seems to interfere with the reaction. In a

number of patients who were given a general anesthetic for purposes of examination or operation, and who had reacted positively before, the injections gave a negative result for the first few days after the anesthesia. Some days later positive reactions were again obtained. When the malignant growth has become very far advanced, positive reactions can no longer be obtained.

Our experience is too small to permit of any statements as to the significance of positive reactions after the carcinoma has been apparently radically removed. In a few patients, on the other hand, in whom the disease seemed to have been completely eradicated, less and less marked reactions were obtained as time went on; finally, no reactions at all could be obtained. In patients in whom the disease was not or only partially removed, injections gave positive results after the effects of the anesthesia or operation had worn off.

CONCLUSIONS. 1. The subcutaneous injection of human red blood cells prepared in the manner we have described is, in certain individuals, followed by a characteristic and easily recognizable local skin lesion or reaction at the site of the injection.

2. The large majority of the patients (89.9 per cent.) in whom this skin reaction was observed were suffering from carcinomatous disease.

3. The large majority of the patients (94.3 per cent.) in whom no characteristic skin lesion followed the injection were free from carcinoma.

Finally, we desire to thank the attending physicians and surgeons of the hospital for their courtesy in placing patients at our disposal, and the members of the house staff for their ever-ready aid in obtaining the clinical material and the data we required.

REVIEWS.

SURGICAL DIAGNOSIS. By EDWARD MARTIN, M.D., Professor of Clinical Surgery in the University of Pennsylvania. Pp. 772; 445 engravings and 18 colored plates. Philadelphia and New York: Lea & Febiger, 1909.

A CAREFUL reading of this work, and an equally careful comparison with other treatises on surgical diagnosis, are amply convincing as to its unusual merit and usefulness. The author has wisely emphasized the paramount importance of *early* diagnosis, and has throughout obviously borne in mind the axiom which he himself enunciates: "The simplicity and safety of surgical intervention are, as a rule, proportionate to timeliness in diagnosis." No better text could have been selected for the teachings of such a book, and it would be difficult to find anywhere in surgical literature a closer adherence to the idea of setting forth the earliest symptomatology on which diagnosis can be based, or a clearer exposition of those phenomena of surgical disease or injury so often first seen by the general practitioner.

The book opens with an excellent chapter on laboratory diagnosis by Dr. Longcope. It might have been well to describe at least the nature of "Cammidge's test," as it was thought worth while to say "the test devised by Cammidge is said to be specific for diseases of the pancreas, and is thought to be especially valuable for the diagnosis of chronic inflammation of the pancreas." The only other reference to this test is on page 526, where, under "pancreatitis," it is said "the urine gives, according to Robson and Cammidge, the pancreatic reaction which they regard as diagnostic." The additional statement that the test is not generally believed to have the value they place upon it would then have left the matter clear to the reader. Under the bacteriology of the urine the relation of rectal conditions to vesical infection might with advantage have been mentioned, though later (p. 671) chronic constipation and dysentery are included among the causes of bacteriuria. No better summary of blood conditions and examinations is to be found anywhere.

Chapter II, by Dr. Pancoast, is an admirable exposition, well illustrated, of the application of the *x*-rays in surgical diagnosis. It is to be assumed that when he says "the risks involved in the radiographic examination are now so slight that they may be practically disregarded," he means risks to the operator and not the risks of misinterpretation. The latter are still with us, and should never be

forgotten. The discussion of the use of *x*-rays in aneurysm, in biliary calculus, and in gastro-intestinal conditions is marked by the good sense and conservatism that are known to be characteristic of the author.

Inflammation, trauma, and tumors are considered in the next three chapters, and are dealt with in outline. The salient diagnostic points are admirably, though perhaps somewhat too concisely, summarized. The article on the skin is excellently illustrated by cuts contributed by Dr. Hartzell. Much information is packed into the dozen pages allotted to this subject, but, again, the condensation is a trifle extreme. The seeker after information about itch, for example, having been told that "diagnosis is assured on finding in an unscratched region a characteristic tunnel, and made absolute by extracting the Sarcoptes scabiei therefrom with a fine needle," would probably desire to know what a "characteristic tunnel" looked like, and perhaps might have the same wish as to the Sarcoptes scabiei. The bloodvessels, muscles, tendons, and bursæ and the bones and joints each have a chapter—and in each case an interesting and instructive one; and nervous diseases are considered in eighty-three pages by Dr. Weisenburg, in a most comprehensive and satisfactory manner. Thenceforward the divisions of the book are on topographical lines—the head, the spinal column, the upper extremity, etc.—with the exception of a good chapter on gynecological diagnosis by Dr. Anspach.

While the excellent plan followed throughout the book in describing the duration of symptoms or conditions (of giving approximate times, that is, minutes, hours, days, etc., instead of using vaguer chronological adjectives) is much to be commended, occasionally it might lead to error. For instance, in describing the diagnostic features of extradural hemorrhage following trauma, Professor Martin mentions (p. 226) "an interval of freedom from symptoms (hours) followed by violent headache." While this is usually true, there are many cases in which the interval could be expressed only in fractions of an hour, or in minutes, and the unqualified use of "hours" might therefore be misleading. The general subject of cranial and cerebral trauma is, however, admirably treated, and in a most clear and accurate manner.

The fractures of the extremities are illustrated by *x*-ray drawings by Dr. Pancoast, from negatives made chiefly at the University Hospital, Philadelphia. They constitute the most complete series of skiagrams of fractures yet published in a surgical text-book. The legends beneath them have been prepared with unusual care, and, taken in conjunction with the accompanying instructive descriptions —in the text—of symptoms and deformities, add greatly to the usefulness of this valuable section. Equally satisfactory are the chapters on the abdomen and on the genito-urinary organs. The synopsis of the differential diagnosis of intra-abdominal swellings

(pp. 490 to 500) is not excelled anywhere, and the articles on cystitis, vesical and renal calculus, the diseases of the kidneys and ureters, are deserving of similar commendation.

In the article on the appendix, though it covers only a little more than four pages, is to be found another excellent example of admirable condensation, of rigid exclusion of the redundant and unnecessary, and of the thoughtful enumeration of every point of absolute value clinically in reaching a diagnosis. The only omission to be noted in this connection is the failure to supplement the clinical signs by those obtained through laboratory examinations, etc. This is probably due to the fact that the blood conditions in appendicitis are described in another section (p. 20), but it would have been well to bring them together. Having regard to the student it is undesirable that the same region should be alluded to as "the iliocostal angle" (p. 522) and the "costovertebral angle" (p. 543). When the author says "from renal pain gallstone colic is distinguished by its upward and backward radiations, absence of tenderness in the ileocecal angle, and usually by urinary findings in the latter condition," he obviously means "former" instead of "latter."

Loss of blood in ordinary hemorrhage, in purpura, in epistaxis, and in intercranial conditions is fully considered, but hemophilia might have been described with special reference to those features of the family history that are often diagnostic. Hemophilic arthritis in young persons is the only allusion to the subject that we have found, except that in the article on blood examination it is truthfully said that it should "be remembered that in hemophilia, a disease which offers great dangers to the surgeon, the coagulation time of the blood may not be decreased."

Leaving aside a few similar trifling oversights we have found, however, very few omissions of any sort, and still fewer errors. If there is a better work than this on surgical diagnosis we are not familiar with it. Believing it likely to be helpful, not only to students and practitioners, but to surgeons themselves, we feel that both author and publishers may be congratulated upon the production of a book which will be a valuable addition to every working surgical library. W. B.

A System of Medicine. By Many Writers. Edited by Sir Clifford Allbutt, K.C.B., Regius Professor of Physic in the University of Cambridge; and Humphry Davy Rolleston, M.D., Senior Physician to St. George's Hospital, London. Vol. V; pp. 969. London: Macmillan & Co., 1909.

As issued in its revised edition, Vol. V of Allbutt and Rolleston's *System of Medicine* is concerned with diseases of the lungs, pleuræ,

mediastinum, thymus, and the blood. The volume opens with an interesting although short account of the physical signs of the lungs and the heart, by Dr. Hector Mackenzie, which is followed by an article on artificial aërotherapeutics, by Dr. C. Theodore Williams. Drs. Goodhart and Spriggs, in discussing asthma, treat almost exclusively of primary or true spasmodic asthma, as contrasted with asthma arising as a complication of preëxisting bronchitis. They regard hay fever as often a spasmodic asthma in its purest form, and they believe the best explanation of asthma to be that which looks upon muscular spasm of the smaller bronchi as the basis of the process; while they mention Curschmann's exudative bronchiolitis, they attempt to minimize its influence, although there is excellent reason for believing that it is the essence of the process in many cases. Dr. William Ewart contributes splendid articles (over one hundred pages) on bronchitis, bronchiectasis, and bronchiolectasis, which are especially characterized by a careful classification, good clinical descriptions, and welcome details regarding treatment. He is disposed to differentiate, at least pathologically, capillary bronchitis from bronchopneumonia. Dr. A. P. Beddard has written the chapter on acute lobular pneumonia and bronchopneumonia, and has revised the chapter on lobar pneumonia originally contributed by Dr. Pye-Smith; the bacteriology and serum therapy has been entrusted to J. Eyre, who extols the value of the vaccine (bacterin) treatment of lobar pneumonia, a form of treatment but little employed as yet, but of much promise and deserving extended trial. Abscess and gangrene of the lung and newgrowths of the bronchi are adequately discussed by Dr. J. J. Perkins. Drs. Percy Kidd, W. Bulloch, and N. Bardswell contribute an excellent account of pulmonary tuberculosis (138 pages). One will find therein about all that is really known of the subject, interestingly and authoritatively set forth. Dr. Bulloch believes that infection is commonly acquired by inhalation rather than by ingestion, but he points out that the spread of the infection once acquired is mainly by way of the lymphatics. The use of tuberculin, controlled by the determination of the opsonic index, is fully set forth; perhaps too much importance is attached to the opsonic index. In addition, Dr. Kingston Fowler contributes articles on syphilis and emphysema; Drs. Rolleston and A. Latham, an article on aspergillosis; Sir Thomas Oliver, an article on pneumokoniosis, based upon large experience; and Drs. F. T. Roberts and J. J. Perkins, an article on newgrowths of the lung. The diseases of the pleura are discussed as follows: Intrapleural tension, by Dr. Samuel West; pleurisy, by Dr. Samuel Gee and T. J. Horder; pneumothorax, by Dr. D. W. Finley; and newgrowths, by Dr. F. T. Roberts and J. J. Perkins. Dr. F. T. Roberts also writes the chapters on diseases, including newgrowths, of the mediastinum, and Dr. Bosanquet the chapter on diseases of the thymus.

Somewhat more than a fourth of the book is devoted to disorders of the blood. The senior editor contributes the article on chlorosis, which is a model of scientific inquiry, clinical observation, and graceful writing. Dr. Herbert French, discussing pernicious anemia, supports Dr. William Hunter in his contention that the disease is a specific disorder consisting in hemolysis, but he is not certain that the postulated toxin is a product of the alimentary tract, preferring to believe that the nature of the toxin and its site of formation are unknown. Drs. R. Hutchison and J. C. G. Ledingham offer a really excellent discussion of the splenic anemias, and a classification satisfactory enough in view of the unsatisfactory state of our knowledge concerning the disorder, or disorders. Dr. Robert Muir contributes the article on leukemia, which is embellished by several colored plates. Dr. F. Parkes Weber writes on polycythemia and erythremia; Dr. A. E. Garrod, on enterogenous cyanosis; Sir Stephen Mackenzie, on purpura; Dr. John Thomson, on hemorrhages in the newborn; Mr. W. Johnson Smith, on scurvy; Drs. Cheadle and Poynton, on infantile scurvy; and Sir Almroth E. Wright, on hemophilia.

As a whole, the volume maintains a high level of consistent effort, of discriminating surveys of contemporaneous medical literature, and of authoritative opinions based upon study and experience and controlled by judgment. A. K.

A Text-book of Gynecological Diagnosis. By Georg Winter, M.D., Professor and Director of the Gynecological Clinic in the University of Berlin, with the collaboration of Carl Ruge, M.D., of Berlin. Edited by John G. Clark, M.D., Professor of Gynecology in the University of Pennsylvania. Translated from the third revised German edition by R. Max Goepp, M.D., Pp. 670; 350 illustrations. Philadelphia and London: J. B. Lippincott Company, 1909.

It seldom falls to the lot of the reviewer to read a volume with greater pleasure than the present. Those who know its earlier German editions will not be surprised at the technical excellence of the translation, and for them any detailed review is superfluous. The volume opens with a section upon the general diagnosis of gynecological cases, which is complete in detail. Besides the usual methods of examination there are sections devoted to cystoscopy, bacteriological diagnosis, and microscopic examination, the latter by Ruge. The second and by far the largest portion of the work is concerned with special diagnosis. Under this heading is included the study of diagnostic methods as applied to all known gynecological conditions. Beginning with the findings in the normal pelvis,

anatomical, palpatory, and histological, the author proceeds to a satisfactory study of the diagnosis of normal pregnancy and of the disturbances which may arise during gestation. Ruge again contributes a most excellence section upon the microscopic diagnosis of pregnancy and of expelled membranes. Space forbids any detailed description of the excellence of this portion of the work; enthusiastic approbation would be our criticism. Displacements of the uterus and the diagnosis of myomas fill up the next eighty pages. To the general reader these chapters will be most instructive, and will certainly be appreciated. The diagnosis of ovarian tumors is followed by the diagnosis of malignant disease of the uterus. As is to be expected, great emphasis is laid upon the early recognition of uterine carcinoma, and the microscopic examination is insisted upon as an aid to this end. A remark made by the author in considering this matter is so timely as to merit incorporation here. In insisting upon the greater need for the microscopic study of suspicious tissue by the general practitioner as compared to the specialist, he remarks that the latter, by his constant training, is often able to differentiate by palpation and specular examination between benignancy or malignancy, while the former "ought, if he were in the habit of making accurate examinations, to see a great many doubtful speculum pictures and feel a suspicious hardness in a great many cases; and for this reason he ought to resort more to the microscope in the diagnosis of cervical cancer than the expert specialist." It is sad to think of the numberless lives now being denied the only chance because men of limited experience will persist in waiting for indubitable macroscopic signs instead of referring the case for operation upon the strength of microscopic study. Sarcoma of the uterus, neoplasm of the vagina and vulva, and microscopic diagnosis of malignant diseases of the uterus, vagina, and vulva follow, the last mentioned by Ruge. The diagnosis of tubal disease, of pelvic peritonitis, and of parametritis is next considered. The last two mentioned sections will particularly repay careful reading. The differential diagnosis of uterine catarrh is too generally neglected by specialists as well as general practitioners. We can heartily commend the two dozen pages upon this subject, and in particular would call attention to the three pages upon gonorrhœa with which the section closes. The division is here made into positive, probable, and uncertain signs. In the second class he has placed pyosalpinx, stating that "it has never been definitely proved that this may be due to some other infection, as tuberculosis." While many will not agree with him in this sweeping statement it has great significance when coming from such an authority. Ruge contributes a section of a dozen or more pages upon the diagnosis by the microscope of endometritis, both of the cervix and body. This portion of the book closes with the diagnosis of diseases of the urinary apparatus—the urethra, bladder, ureter,

and kidney being considered. The third and last division of the work, comprising over fifty pages, is devoted to analytical diagnosis; the causes of hemorrhage, amenorrhœa, dysmenorrhœa, sterility, and the analytical diagnosis of abdominal tumors being the subjects dealt with. We look upon this portion of the work as exceedingly valuable, since, summing up as it does much that is scattered through the body of the book, it will be the means of finally fixing in the mind of the reader many diagnostic viewpoints of great importance. A review of this work would be most incomplete were the translator's work to pass unnoticed. Dr. Goepp has faithfully performed a most arduous task, and has produced a translation which, while departing in no respect from the literalness demanded, has an enviable smoothness in construction.

We are confident that the profession in this country and England will give the volume a very hearty welcome. W. R. N.

PRATIQUE DE LA CHIRURGIE ANTISEPTIQUE. Leçons Professées à l'Hôtel Dieu. By le Docteur JUST LUCAS-CHAMPIONNIÈRE, Honorary Surgeon to the Hôtel Dieu, Member of the Academy of Medicine, Member of the Council of Hygiene and Health of the Department of the Seine. With a portrait of Lord Lister. Pp. 464. Paris: G. Steinheil, 1909.

IN 1874 Lucas-Championnière made, at the Hospital Lariboisière, the first trial in France of antiseptic surgery, which he had seen employed by Lister at Glasgow in 1868; in 1876 he published his *Manuel de Chirurgie Antiseptique*, and this was the first adequate presentation of the subject in any language. The present volume, comprising 33 chapters, is an entirely new work, founded on the veteran surgeon's lectures at the Hôtel Dieu, and addressed especially to young surgeons or to those practitioners whose intellects are not beclouded by the teaching of certain masters, or enslaved by "écoles théoriques et intransigeantes."

The work, in fact, is as much a polemic against aseptic surgery as it is an exposition of antiseptic practice. The author does not hesitate to mention by name the lamented Terrier, to whom more than to any other one man is due the revolution in the administration of hospitals in France, who for so long stood at the head of French surgery, and without whose devoted attention to the development of aseptic technique the surgery of the viscera could never have reached its present advanced state; and Quénu, one of Terrier's most distinguished pupils, is also named; and the modern operating room, its furniture, the aseptic costume of the surgeon, and every modern improvement, are unmercifully ridiculed and decried as

unnecessary and, therefore, undesirable. This raucous voice from the past laments the disappearance of the carbolic spray, which he abandoned because his assistants took malicious pleasure in neglecting its use in his absence, that is to say, at times when it would have been most useful; and he thought it better to abandon it than to make bad use of it. He no longer uses the green protective only because it is no longer manufactured. He has compromised for giving up the impermeable dressing by the employment of copious coverings of weak iodoform gauze. He places his main reliance on carbolic acid; soaks his hands and instruments in it; swabs out all his wounds with it; drains all his cases of operation for the radical cure of hernia with a rubber tube "because it makes the scar firmer;" wears no gloves; prohibits the use of nail brushes on the skin of surgeon or patient; and glories in the fact that in the filthiest surroundings he is able to secure clean wounds by these means.

No surgeon worthy the name will ever fail to appreciate the debt of modern surgery to antisepsis; and it would be well if many modern surgeons would stop seriously to consider the many slight, but in the aggregate important, lapses from the antiseptic method which they constantly permit themselves. Says Championnière: "The perfection of modern surgery is such that we have not the right to deprive those who intrust themselves to us of the least of the advantages which we can give. An apparently slight neglect is enough to lead to useless suffering, and you will often see it. You will see a little suppuration in one corner of the wound. You will see crusts which last indefinitely; you will see a wound which has gaped open at the site of one suture; you will see, what is graver yet, a suture discharged from the wound some days, weeks, or months after the operation. Now, *in the immense majority of cases*, these little incidents, which inflict useless miseries on the patient, are faults or negligences of the operator."

The further one reads into the volume, the deeper becomes the impression that it speaks the truth, and nothing but the truth, but not always the whole truth. Because a thing is possible, it is by no means always expedient; and to ignore the advantages wrought by asepsis is characteristic of "intransigeance" of a marked degree. Yet the author's results by his strict adherence to antiseptic methods are marvellous; he cites, for instance, his series of excisions of the knee, with only one death (delirium tremens), in the 133d case; he claims to have operated on more fractures of the patella than any surgeon in the world, and with none of the precautions adopted in aseptic surgery, and with never a case of septicæmia; he mentions his 1135 operations for the radical cure of hernia, with only 4 deaths, none from septicemia; he was the first to practise cerebral surgery, and he remains, he asserts, one of those who have practised it longest and most completely, but with never a single case of sepsis in his experience. He does not blow his own horn so loudly in regard to abdomi-

nal surgery; and he claims that aseptic surgery, which finds its particular field here, succeeds because the peritoneum is less disposed than the other tissues to infection through the air. The failure of aseptic methods in other departments of surgery he holds an insuperable objection to its general adoption. Granted that these premises are correct, which we do not believe, it is surely enough to be thankful for that modern abdominal surgery has developed from the practice of aseptic methods; and even though aseptic practice has its limitations, it is an advance in suitable cases, and in such must not be lightly abandoned. A. P. C. A.

THE PRINCIPLES OF BACTERIOLOGY. By A. C. ABBOTT, M.D., Professor of Hygiene and Bacteriology in the University of Pennsylvania. Eighth edition; pp. 631; 100 illustrations. Philadelphia and New York: Lea & Febiger, 1909.

EIGHT editions tell the story of Abbott's *Bacteriology*. Originally published when bacteriology may be said to have been in its mewling and puking infancy, it has been since its birth perhaps the most popular students' book and has exerted a marked influence in diffusing a knowledge of bacteriology; indeed, one may say that much that most practitioners of medicine, as well as avowed bacteriologists, know of the subject is founded upon what they learned originally from Dr. Abbott's book. Extended comment of the new edition is scarcely necessary. It has been brought thoroughly abreast of the times, and now contains the important facts and the latest trustworthy opinions regarding a branch of medicine that is advancing with rapid strides. Special attention has been paid to infection and immunity, including the antitoxic, bactericidal, and phagocytic properties of the blood, and the use of vaccines in the prevention of certain infections, etc. As heretofore, the book may be warmly recommended; there is no better of its size. A. K.

VORLESUNGEN UEBER TUBERKULOSE: I. DIE MECHANISCHE UND PSYCHISCHE BEHANDLUNG DER TUBERKULOSEN BESONDERS IN HEILSTATTEN. By DR. GEORGE LIEBE, Director of the Heilanstalt Woldhof Eigershausen. Pp. 275. München: J. F. Lehmanns, 1909.

THE vast amount of literature on tuberculosis that has appeared during the last few years is so appalling that only the stoutest-hearted dares even contemplate keeping up with a fraction of what

has been written. It is not strange that much of the literature on the sanatorium treatment of tuberculosis should come from Germany, for there the sanatorium treatment has been applied far more extensively than in any other country. Dr. Liebe has prepared his lectures on tuberculosis so that they can be understood by students of medicine who wish to know about the sanatorium treatment without a sojourn in one of these institutions. The first part of his book deals with the mechanical and physical treatment in sanatoriums and contains much that is admirable. He is inclined to allow his patients much more latitude in regard to exercise than many sanatorium physicians approve of, and for this he is censured by Schroeder. He believes in pulmonary gymnastics and also in teaching patients how to breathe properly. His attitude on alcohol is similar to that held by many physicians in America—that it should be dispensed only by the druggist and not as wine or beer. He deals with many subjects that are not ordinarily touched upon, such as religion and the church, the ethics of the sanatorium, as well as the desire for learning that many of the patients manifest. American literature is not particularly well covered, though the German literature is very well gone over, and sixty pages are devoted to notes and criticisms of various articles from the literature. On the whole, the book contains much that is of interest, little, however, that is new; but the author's opinions and criticisms of the various subjects that he discusses makes the book interesting reading

L. B.

PHYSICAL DIAGNOSIS. By RICHARD C. CABOT, M.D., Assistant Professor of Medicine in the Harvard Medical School, Boston. Fourth edition; pp. 579; 245 illustrations. New York: William Wood & Co., 1909.

SINCE Dr. Cabot's *Physical Diagnosis* has long since achieved a permanent place in medical literature and is widely used in medical colleges as the required text-book, one need do no more than chronicle the issuance of a new edition. The book has been materially improved and considerably enlarged; many minor changes and alterations have been made throughout; the chief additions concern the use of the free ear in auscultation, the discussion of bronchiectasis, and the differences between the sides of the chest. The author states also that some of the pictures have been changed, and he hopes improved; but in this instance, realization falls short of hope: most of the illustrations remain as they have always been, very poor examples of the engraver's and printer's art—the only bad features of an excellent book.

A. K.

THE THERAPEUTICS OF RADIANT LIGHT AND HEAT AND CONVECTIVE HEAT. By WILLIAM BENHAM SNOW, M.D., Editor of the *Journal of Advanced Therapeutics* and late Instructor in Electrotherapeutics in the New York Postgraduate School. Pp. 119; 15 illustrations and 8 plates. New York: Scientific Authors' Publishing Co., 1909.

THE author modestly proclaims in his preface that he has been induced to write this condensed manual at the request of students and other members of the profession, and not at all because of the fact that he wanted to inflict the medical public with his own views. He further states that in considering the subject, attention will be devoted to the elucidation of physiological actions, practical indications, and methods of employing radiant light and heat from the modern point of view, by which, of course, he means his own point of view.

This is a beautiful book. It is full of illustrations of the different forms of electrical implements, the number and variety of which is beyond one's imagination, interspersed here and there with a new cabinet by the author, with modifications and methods of treatment. The explanation of the physiological effects of light and heat is well set forth, providing one is willing to believe what the author has to say. For instance, when discussing the derivative effects produced by extensive exposure he states that "there is pronounced lessening of the quantity of blood in the congested regions and large arteries and veins, lowering of arterial tension, relief of the overworked heart, and coincidentally promotion of extensive elimination of the locked-up products of poor metabolism." Most of the book is taken up with the methods of application of radiant light and heat and the benefits to be derived therefrom. According to the author, there is no disease to which the human is heir which cannot be benefited by electricity. All sorts of pains are relieved, postoperative cases benefited, myalgias cured, and the different germs which cause inflammation brought into a state of complete inhibition. The Röntgen rays, according to him, can cure cystitis, prevent and cure otitis media, whether acute or chronic, carbuncles, furuncles, felons, suppurative tonsillitis, tuberculous arthritis, adenitis, pelvic congestions, ozena, postoperative iritis, etc. Radiant light and heat, according to him, can cure varicose ulcers, lupus and allied conditions, eczema, psoriasis, all sorts of spinal conditions and nephritis, to say nothing of arteriosclerosis. This reads like an advertisement, and expresses about as well as anything could what the book is.

T. H. W.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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A New Sputum Test.—FALK and TEDESCO (*Wien. klin. Woch.*, 1909, xxii, 954) have proposed a method for differentiating disease processes limited to the bronchial mucosa from those which have extended to the lungs. Their method is based on the fact that salicylic acid, present in the blood, appears in inflammatory exudates, but is not excreted by the bronchial mucosa. Patients with expectoration are given 2 grams of sodium salicylate. The sputum is collected for the next twelve to fifteen hours and examined as to its content of the drug in the following manner: The entire sputum, slightly acidified, is thoroughly shaken with five times its volume of 96 per cent. alcohol. Albumin and mucous-forming bodies are precipitated in coarse flocculi and removed by filtration, since they contain none of the salicylate. The clear filtrate is rendered slightly alkaline and evaporated on a water bath; the residue is dissolved in water, slightly acidulated, and sugar of lead added. The precipitate is removed by filtration, the precipitate being washed, and the acid filtrate is extracted with ether. The ethereal extract is now evaporated, the residue taken up in 10 c.c. of water, and 1 c.c. of 10 per cent. aqueous ferric chloride is added. In the presence of salicylates, the solution is colored violet. Patients suffering with acute catarrhal bronchitis, chronic bronchitis of emphysema, bronchial asthma, purulent bronchitis, bronchiectasis, and bronchial catarrh of cardiac origin, all reacted negatively. In two cases of lobar pneumonia a strong positive reaction was seen; in one diplococci, in the other streptococci, were found in the sputum, with typical signs in the lungs. The reaction gradually lessened until the crisis, then quickly disappeared. The intensity of the reaction was roughly proportional to the extent

of the lesion. In two other cases without physical signs in the lungs, proved by autopsy to be central pneumonia and bilateral gangrenous pneumonia respectively, a marked reaction occurred. In tuberculosis the results varied considerably. A positive reaction was met with in all cases, but the intensity of the reaction was not proportional to the clinical severity or extent of the pulmonary process. In general, however, the acute cases gave a stronger positive reaction than the chronic ones. From their experience with the test, Falk and Tedesco conclude that a repeatedly negative test is strong evidence that the disease process is limited to the bronchial mucosa. A very strong reaction (dark violet color, even after diluting five to ten times) indicates an extensive inflammatory (exudative) process in the lung itself, as in pneumonia. In doubtful cases in which the diagnosis lies between bronchitis and tuberculosis, a positive reaction favors the latter. Furthermore, cases of central pneumonia, unrecognizable by physical signs, should be strongly suspected with a marked positive reaction.

The Relationship of Anæmia Pseudoleukæmica Infantum to Rachitis.—Aschenheim and Benjamin (*Deut. Archiv f. klin. Med.*, 1909, xcvii, 529) have made a careful clinical and pathological study of 5 cases of so-called anæmia pseudoleukæmica infantum, and in addition have analyzed 70 recent cases in the literature. In all but 5 of these cases rickets existed definitely, and in 50 per cent. of them it was of severe grade. In the majority of cases in which autopsy has been performed, lymphoid "degeneration" and erythroblastosis of the bone marrow have been demonstrated. Similar alteration of the marrow is not uncommon in rickets. Aschenheim and Benjamin believe that anæmia pseudoleukæmica infantum results from the degenerative process of the bone marrow, which is one of the effects of rickets. The disease is, therefore, not a clinical entity, but rather a sequel of rachitis, comparable to tabes dorsalis after syphilis. As an expression of the lymphoid marrow, they find a marked reduction of the polymorphonuclear neutrophiles, and the numerous nucleated reds are due to red cell hyperplasia. The blood picture need not include a diminution in number of the erythrocytes or a leukocytosis, as their own cases and others in the literature show. The large mononuclears are usually increased. Myeloid metaplasia of the spleen is frequent, and even the liver may take part in the blood formation. The authors suggest that the condition be designated rachitic splenomegaly, and that the old names, anæmia splenica, anæmia pseudoleukæmica infantum, and anæmia pseudoperniciosa, be dropped.

A Peptid-splitting Ferment in Cancer of the Stomach.—Fischer has shown that digestion progresses further with proteins in carcinomatous stomach contents than in the normal stomach. Thus, the HCl deficit with normal chlorine content is explained. By the splitting of the proteins into polypeptids and eventually into mono-acids and diamono-acids, amino groups become free; these bind HCl, and, therefore, when present in sufficient quantity, may produce an HCl deficit, while the total acidity increases through the presence of the free carboxyl groups. This extended hydrolysis of proteins cannot be carried on by the pepsin-HCl of the gastric juice, but is done normally in the intestines by trypsin

The blood also contains ferments capable of similar work. In the absence of pancreatic juice and blood in the carcinomatous stomach contents, it would appear that another ferment must be present, which is capable of extended hydrolysis of proteins.

NEUBAUER and FISCHER (*Deut. Archiv f. klin. Med.*, 1909, xcvii, 499) have studied the gastric contents in health and disease, with a view of determining the presence of a specific ferment in carcinoma. They selected a polypeptid, glycyltryptophan, with which they test for the presence of a peptid-splitting ferment; if present, tryptophan is formed. This may be recognized by a reddish-violet coloration on the addition of bromine water. Numerous experiments have shown that there is present in malignant tumors, both sarcomas and carcinomas, a ferment capable of splitting glycyltryptophan very much more rapidly than that found in normal tissues and benign tumors. No cleavage whatever is produced by the pepsin-HCl from human and canine stomachs. Experiments have also shown that possible peptid-splitting ferments in yeasts, moulds, and bacteria are eliminated, with the technique adopted, by filtration of the gastric contents or, more simply, by the addition of toluol. Gastric contents which contain pancreatic juice or blood are obviously unsuited for examination. The absence of the former may be determined by testing for bile with dilute tincture of iodine, while the latter is tested for by the acetic acid-ether and guaiac tincture test of Weber.

Technique.—The test breakfast is removed after one-half to three-quarters of an hour. It is tested for bile (and consequently pancreatic juice) and for blood; if either are present, the specimen must be discarded and another obtained. The gastric contents are then tested with bromine water to exclude the presence of tryptophan; if this test is positive, it also necessitates obtaining a fresh specimen. All of the three tests being negative, about 10 c.c. of filtered gastric contents is placed in a test-tube with a little glycyltryptophan, covered with toluol to prevent bacterial growth, and put in the incubator for four hours. With a pipette 2 to 3 c.c. is withdrawn and acidified with a few drops of 3 per cent. acetic acid. Bromine vapor is allowed to settle in the test-tube until a light brownish color is seen in the upper part of the tube; the contents are shaken, and if a rose color develops, free tryptophan is present, and the test is positive. An excess of bromine must be avoided, as it causes a disappearance of the rose color. If no rose color is seen, one adds bromine fumes carefully as before, shakes, and observes. One continues in this way till the fluid in the test-tube shows a light yellow color, which indicates an excess of bromine and a negative result. Calcium chlorate, $\frac{1}{10}$ saturated aqueous solution, may be substituted for the bromine; the same color and similar difficulties are met with.

Applying their method to clinical work, Neubauer and Fischer obtained negative results in 4 normal stomachs, 10 ulcers of the stomach, 12 gastric diseases other than carcinoma, 4 cases of suspected carcinoma, and in the vomitus of 2 cancer cases. A positive result was obtained in 17 cases of cancer of the stomach and in 6 suspected cases. The results demonstrate the presence of a ferment (which is inactivated by 0.36 per cent. HCl) in carcinoma of the stomach, which hydrolyzes polypeptids, and indicate its usefulness as a diagnostic procedure.

The Effect of Febrile Diseases in Diabetes Mellitus.—Brasch (*Deut. Archiv f. klin. Med.*, 1909, xcvii, 508) has studied the effect of intercurrent febrile diseases on the metabolism of diabetics and arrives at the following general conclusions: (1) Febrile diseases may increase or decrease the glycosuria in diabetes mellitus. (2) Mild cases of the disease usually show a decrease in the quantity of glucose, without subsequent ill effects. (3) Increase of glycosuria and the occurrence of acetonuria may be seen in severe cases of diabetes during febrile diseases; in some instances, however, no change in the excretion of sugar is noted during the course of the fever, but subsequently the patients rapidly decline. (4) The cause of the fever is of less moment than the severity of the diabetes.

Experimental Functional Mitral Insufficiency.—Lian (*Archiv. des mal. du cœur, des vaisseaux, et du sang*, 1909, ii, 569) has studied experimentally in dogs the functional insufficiency of the auriculoventricular valves, which occurs shortly after the onset of asphyxia. The insufficiency dependent on asphyxia is the result of several factors; an increase of arterial pressure in both the greater and lesser circulations, the malnutrition of the heart from the poorly oxygenated blood, and the action of the pneumogastric nerve in slowing the heart rate, increasing the length of the diastole, and diminishing the tonicity of the myocardium. The tracings of the volume curve of the left auricle show that insufficiency begins synchronously with the onset of ventricular systoles. It disappears as soon as the animal is allowed to breathe normally, but may be brought on again by subsequent production of asphyxia. It was possible to cause insufficiency at intervals of several days in the same dog, there being in the meanwhile apparently complete recovery. In several instances functional insufficiency was produced without opening the thorax; it was accompanied by a well-marked systolic murmur localized at the apex. Neither stimulation of the pneumogastric, or sudden compression of the aorta usually cause insufficiency. The conditions which appear to be necessary to the production of functional insufficiency of the mitral valve are a diminution in the tonicity of the myocardium, and an overdistended left ventricle.

Blood Regeneration from Diminished Oxygen Tension.—Kuhn and Aldenhoven (*Deut. med. Woch.*, 1909, xxxv, 1958) refer to the recent studies on regeneration of the bood, with increase in the total volume of the blood, following the use of the suction-mask (Saugmaske). The red count may be increased 1,000,000 to 3,000,000 cells per cubic millimeter by the daily use of the mask, and, indeed, the rise begins almost at once. There is a coincident, but slower, augmentation in hemoglobin. Exactly similar findings may be obtained in persons going from the sea level to high altitudes. Likewise, after dyspnœa, polycythemia and increase in hemoglobin have been noted, lasting for some time. As experiments have shown, these results are not due to a loss of plasma (concentration of the blood); there is an actual increase in the total quantity of blood and of hemoglobin, and the bone marrow in the shafts of the long bones is red, rather than fatty. The cause of these phenomena is a lowered oxygen tension in the tissues. The rapid regeneration which follows hemorrhage is probably due to the

same cause. The response is extremely prompt, as Müller has shown. It is well known that the administration of arsenic leads to increase of the erythrocytes. Similarly it has been noted that the administration of tuberculin is often followed by an increase in the red cells. It is equally well known that arsenic is a hemolytic poison. Kuhn and Aldenhoven, therefore, have attempted to explain these facts by experiment. They made a series of observations in guinea-pigs to which atoxyl and tuberculin were administered, and found an initial fall in the blood count, followed by a rise, due, they believed, to a primary lessening of the oxygen tension from destruction of red cells; this resulted in stimulation of the bone marrow sufficient to produce a subsequent rise. To determine this point the experiments were repeated on a second series of animals which were kept in cages so constructed that the inspired air could be surcharged with oxygen. In all the animals there was now a steady decline in the number of red cells in the blood. They conclude that arsenic does not affect the bone marrow primarily, but that the stimulus to erythropoiesis is due to the lowered oxygen tension caused by destruction of red cells.

The Auriculonodal Junction.—In the study of the system of conduction fibers in the hearts of cats, rabbits, monkeys, dogs and goats, COHN (*Heart*, 1909, i, 167) has found that there is constantly present a connection between the fibers of the auriculoventricular node of Tawara and the muscle of the auricle. In the cat the fibers of the dorsal portion of the node become thicker and gradually pass into the auricular fibers. Sometimes two or three of the smaller fibers unite to form an auricular fiber. The number of nuclei in the muscle fibers decrease progressively in the passage from node to auricle, but the transverse striations, which are rarely seen in the nodal fibers, come out more clearly in the transition fibers, and become fully developed in the auricular fibers. In the monkey, at the point of passage from auricle to node the fibers become plumper, more nearly parallel, and the fibers of one become continuous with those of the other. The passage from auricle to node is so gradual that it is impossible to say where one begins and the other leaves off. In dogs, cats, and rabbits collections of ganglion cells were found close above the point of transition from auricle to node. In the monkey no nerves were found in or near the bundle or node, but many were seen in the interauricular system. The position of the A-v node was found to be variable. While it is usually found on the right side of the interauricular septum, it may be in the mid-line, or even nearer the left side. These variations are explained as due to embryological variations in the formation of the auriculoventricular groove at the membranous septum.

The Treatment of Amœbic Dysentery in the Canal Zone.—From 1905 to 1909 there were 211 patients treated for amœbic dysentery in the Ancon Hospital. In 82 of these various methods of treatment were used, including opiates, ipecac, castor oil, magnesium sulphate by mouth, and local irrigations of quinine, thymol, silver nitrate, starch, boric acid, tannic acid, etc. In this series the mortality was 39 per cent., and the average time in the hospital twenty-eight days. Another series of 129 cases was treated by what OEEKS and SHAW (*Medical Record*,

1909, lxxvi, 806) call the "rest-supportive" method. The average time in the hospital for these cases was twenty-one days, and the mortality 18 per cent. The essential features of the treatment were absolute rest, a strict milk diet, saline or water irrigations, and bismuth subnitrate in heroic doses. A mild irrigating fluid is preferred since it cleanses the mucous membrane without irritating it and favoring the invasion of fresh areas. A milk diet provides the most perfect food, and causes less intestinal putrefaction than others. The bismuth is given in doses of 1 dram to 1.5 dram (by measurement) every three hours until there is a general improvement—from three to fifteen days. Toxic effects were never seen. There have been no relapses among the cases receiving this treatment. Herrick (*Ibid.*, p. 810) groups those cases of amœbic dysentery needing surgical treatment in three classes—those that have become chronic and remain so under the best medical treatment; acute fulminating cases with extreme toxicity; and severe acute cases resisting medical treatment, and going down hill. Most of the cases operated on at Ancon belong to the last group. As to the operation to be performed, he believes that in the earlier, milder cases, when the process is mainly on the surface layers of the bowel, appendicostomy with irrigation of the bowel is indicated. When, however, the deeper layers of the intestines are involved as in the more severe cases, complete rest of the large bowel is desired, and cecostomy is the operation of choice.

Actinomycotic Cerebrospinal Meningitis.—HENNY (*Jour. Path. and Bact.*, 1909, xiv, 164) reports the case of a man, aged twenty-six years, who developed an abscesss of the right upper jaw after having had a carious tooth extracted. Incision of the abscess was followed by partial healing and sinus formation. On four occasions the abscess was opened. Ten days after the last operation—over one year after the onset of the trouble—he began to develop cerebral symptoms. Headache, pain over the spine, and fever were followed by rigidity of the neck, Kernig's sign and opisthotonos. Death occurred in the fourth week. On lumbar puncture about 2 c.c. of very thick fibrinous fluid were obtained. At autopsy the base of the skull and the spinal cord were covered with a thick, viscid exudate. Typical actinomycotic granules were obtained from the cerebrospinal exudate during life, and from the operation wounds. Anaërobic cultures yielded a growth such as is described as typical for the organism of actinomycosis. An examination of the literature reveals only twenty-five similar cases, and in several of these the identity of the etiological organism is extremely doubtful. In the great majority of the reported cases the involvement of the meninges was secondary to a general infection or to a primary growth elsewhere, and was the determining cause of death. The lungs and bronchial glands are the common seat of the primary lesion. In only three cases was the infection due to direct extension from the tissues of the neck and face.

SURGERY.

UNDER THE CHARGE OF

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Ureterocele (Hernia of the Ureter).—CACCIA (*Archiv. gén. de chir.*, 909, iii, 991) collected 22 cases from the literature and reports two personal observations. It may or may not be accompanied by a peritoneal sac, that is, it may be paraperitoneal or extraperitoneal. Each variety may occur alone or be accompanied by a cystocele or hernia of the bladder. Any of these varieties may be found in the inguinal or femoral regions. Ureterocele is very rare, yet one should think of it if he finds an abnormal cord in contact with the hernial sac. The preoperative diagnosis, although it has not yet been made, is possible. The clinical characteristics which permit it are as follows: There will be incomplete reducibility of a hernia, in connection with which there is felt a soft cord, which is not reducible, does not feel like an intestinal wall, a varicose vein, nor an empty hernial sac. Gurgling on reduction of the hernia is absent, and there may be perceived coincidently a hydronephrotic sac. Ureteral difficulties may be present, characterized by a diminution of the secretion of urine especially upon the application of a bandage, and their disappearance after the removal of the bandage. Evidence may be produced by the cystoscope and the ureteral catheter. There may be vague symptoms, such as painful micturition, hematuria, abdominal and lumbar pains from intermittent hydronephrosis. In the course of the operation the ureteral contractions should be watched for. The prolapsed portion of the ureter is usually dilated, and the weight of the urine, the vis a tergo, and the ureteral contractions, facilitate the course of the urine. Extraperitoneal ureterocele is probably congenital. Paraperitoneal ureterocele has a complex mechanism and its causes are multiple. Ureterocele combined with a cystocele has also a complex pathogenesis. If the portion of the ureter adjacent to the bladder is prolapsed, the cystocele is only a concomitant lesion, the ureterocele being simple and not due to the cystocele. The simple, paraperitoneal, femoral ureteroceles are more frequent than the inguinal, because as the experimental evidence shows, prolapse into the femoral canal is more easy than into the inguinal canal.

The Late Results of Removal of the Breast for Cancer.—FIDELIN (*Archiv. gén. de chir.*, 1909, iii, 999) reports the results of a study of the late results of operation for cancer of the breast in 234 cases operated on by Mauclaire, Guinard, Hue, Routier, and Schwartz; and of a detailed analysis of the work of Handley upon cancerous permeation. The

average duration of life in patients with cancer of the breast and not operated on, is forty-four months. While the surgical treatment is not ideal, at the present time it is our only means of arresting the progress of the growth, that is, the wide and early operation. Definite cure is rare; in fact, it can never be considered absolute, because one sees recurrences twenty and thirty years after operation, although in the interval no disturbing sign was manifest. The progress realized by surgery in the last half century, is encouraging. According to Depage, who studied a large number of statistics, it was found that the percentage of cures three years after operation, between 1865 and 1875, was 9.4 per cent.; between 1875 and 1885, 10 per cent.; between 1885 and 1895, 34.3 per cent.; and between 1895 and 1905, 46.3 per cent. The recurrences from 1865 to 1875 were, locally, 76 per cent.; glandular, 8.4 per cent.; and at a distance, 7.5 per cent.; from 1875 to 1885, locally, 72 per cent.; glandular, 6.2 per cent.; and at a distance, 10 per cent.; from 1885 to 1895, locally, 45.5 per cent.; glandular, 8.4 per cent.; and at a distance, 19 per cent.; and from 1895 to 1905, locally, 29 per cent.; glandular, none; and at a distance, 23 per cent. 'Surgeons are not agreed on the question of the detachment of the muscles. Some conserve the pectorals, arguing that muscular recurrences are rare, and that by sacrificing these muscles the patients are much crippled. Others remove them systematically, because in certain cases neoplastic nodules are found under the pectorals, which are apparently healthy. The statistics permit discussion on this point. Muscular recurrences have been observed in patients who have undergone a wide operation by the Halsted method. The progressive diminution of recurrences can be attributed only to the improved operative technique. Modern methods at first view appear to give a lessened period of survival, but this proves erroneous when applied to a large number of cases. When we find an ideal method of operation, the recurrences will take place only when there exist unrecognizable metastases at the moment of operation (Handley). According to Handley, a certain number of recurrences, which formerly were regarded as fatal, are due to the negligence or rather the false conception of the operator regarding the mode of dissemination of cancer. He says that in the future we can avoid these by resecting widely the superficial fascia, along which the infection extends to distant parts.

Experimental Artificial Anemia in Intracranial Operations.—SAUERBRUCH (*Zentralb. f. Chir.*, 1909, xxxvi, 1601) had previously shown that with the aid of his pneumatic cabinet, through the local effect of sufficient excess of pressure on the opened skull, the venous hemorrhage from bone and brain could be completely arrested, while the arterial could be considerably diminished. The compression of the capillaries and veins required a pressure of from 20 to 30 mm. of mercury, while the compression of the arteries required a pressure of at least 70 mm. of mercury. At the same time the brain was more or less compressed and contracted. The method is not, however, available for man. The frequent occurrence of air emboli proved to be a great danger, and the technique of the method was too complicated to be of value for other than experimental purposes. More recently, Sauerbruch has been experimenting upon the hemostatic effect produced by the

reduction of the normal atmospheric pressure. The animal was placed in the pneumatic chamber, as for the performance of an intrathoracic operation, the head being outside, the breast, abdomen, and extremities inside the chamber. An air tight closure was made about the neck. The opening was then made in the skull which was outside, and as soon as the air pressure within the chamber was reduced to about 15 mm. of mercury, the venous hemorrhage was considerably diminished and at 20 mm. pressure it was completely arrested. The brain contained little blood, and consequently its surface was depressed, about 1 cm. In this period the large venous sinuses could be opened without hemorrhage. The arterial bleeding was reduced only when the air pressure within the cabinet was diminished to about 40 mm. Upon the removal of the lowered pressure within the cabinet, the brain soon increased to its normal size, and the bleeding returned. The decrease of pressure over the chest leads to a marked expansion of the chest, and to a marked aspiration of venous blood into the right heart. The breathing and heart action, however, are not seriously disturbed. The capillaries in that portion of the body within the cabinet, especially in the abdomen, are considerably dilated, and the dilated vessels take up a large part of the circulating blood. A laparotomy undertaken at the same time as the opening of the skull will demonstrate the filling of the veins of the abdomen. The blood pressure in the carotid and femoral arteries is not changed, that in the jugular vein is decreased during diminution of pressure in the cabinet. Pressure on the abdomen increases the pressure in the abdominal vessels and induces a normal filling of the brain with blood. After a ligation of the external jugular on both sides, the intracranial venous anemia, from decreased pressure within the pneumatic cabinet, either is not obtained or is obtained only with difficulty. Nor does it occur if the abdomen is distended abnormally, as by an overfilled bladder or pregnant uterus. In dead animals the veins will be emptied by a pressure of 7 mm. of mercury within the cabinet, but pressure upon the abdomen immediately refills them. Air emboli do not develop with this method, because of the resulting diminution of the caliber of the vessels. Dangerous results from the effect of this method on the brain have not been observed.

The Diagnosis of the Dilated Renal Pelvis by Means of Filling it with a Colloid Silver Solution and Skiagraphy.—VOELCKER (*Archiv f. klin. Chir.*, 1909, xc, 558) has employed this method in a series of cases, and has found it of value for the diagnosis of the position of the kidney, of the degree of dilatation of the pelvis, and of the degree of dilatation and position of the ureter. The normal pelvis reaches its maximum capacity at 2, 3, or 4 cm. The ureteral catheter is introduced to the renal pelvis, that is, to a distance of from 20 to 25 cm. Distention of the normal pelvis with the collargol solution usually gives rise to pain lasting about twelve hours, but to no permanent injury. Chronically dilated pelves give no pain when distended by the fluid. The ureteral catheter impregnated with bismuth is often left in position in the ureter. When the catheter is introduced to the kidney, the capacity of the pelvis may be determined as well as the existence of residual urine in it. The collargol is usually in a 2 per cent. solution, is a good antiseptic, and has a therapeutic effect upon the conditions due to the dilatation and

retention, sometimes very marked. It is only very slightly irritating, and, therefore, causes very little or no pain. That which does develop is due to the tension from the overfilling of the pelvis. As it is a dark fluid, it can be seen escaping into the bladder alongside the catheter. It also lends itself to the skiagraphy of the pelvis and ureter. The occurrence of pain in the kidney region and the escape of the collargol solution into the bladder will indicate that the pelvis is filled to its maximum. By this method Voelcker found that some pelves received 5 cm., others 10, 15, 30, 35, 120, and 150 cm. of the solution. The skiagrams were taken sometimes in the lying position and when possible during arrest of respiration. He has devised a special apparatus, which permits the skiagram to be taken in the standing position. While the normal renal pelvis is on a level with the first lumbar vertebra, in movable kidneys it varies, in some being on a level with the second, in some with the third, and in one case with the fourth lumbar vertebra. The ureter participated in the depression in three different degrees: (*a*) It sank entirely with the kidney, having a tortuous course without actual kinking; (*b*) it remained fixed throughout, kinking at its junction with the pelvis; (*c*) it remained fixed in its chief part, while its renal portion moved with the kidney. In these cases, and they proved the most frequent, the ureter was kinked, generally, a few centimeters below the renal pelvis.

Concerning the Question of Trephining in Traumatic Injuries of the Vault of the Skull.—Kusnetzow (*Archiv f. klin. Chir.*, 1909, xc, 1025) says that in compound depressed fracture of the skull operative intervention as soon as possible is the best method of treatment. One can say with certainty that the more frequent and the earlier the operation, the better the results. In simple fracture, operation is indicated if brain symptoms are present. Excessive delay may have an injurious effect upon the patient, so that the latter should be watched and operation done on the appearance of brain symptoms. Fissured fractures may be treated expectantly, but since even in mild cases of this variety dangerous symptoms may arise suddenly, the patients should be watched carefully. These dangerous symptoms may develop in the form of high temperature, convulsions, paralysis, and focal brain symptoms, and indicate urgent operation. The indications for operation in injuries to the skull should be decided after a careful study of every individual case and a consideration of all the clinical symptoms, avoiding dependence on the typical picture. In compound fractures resection of the skull, by means of the various chisels and bone forceps, is to be preferred to the typical trephining by means of the various trephines and drills. The chief requirements for the success of the operation are: (*a*) A sufficient widening of the defect in the skull; (*b*) a careful removal of the bone fragments and shreds of membrane, as well as a careful suturing of the deficient fibrous structures and torn brain substance; (*c*) careful hemostasis; and (*d*) the introduction of absorbent drains. Primary trephining in recent cases gives better results than the secondary, and shortens especially the period of wound healing. When meningitis complicates a compound fracture of the skull, the best method of treatment consists in a free exposure of the brain by a wide removal of a portion of the skull and the introduction of drainage

tampons under the opened dura mater. Extensive fractures of the skull, which have necessitated operative intervention, require long-continued observation of the patient afterward, in order to study the later condition of the central nervous system. Wounds of the frontal lobes may be accompanied by a peculiar change in the character and disposition of the patient, which has been described by Jastrowitz as a quibbling disposition.

Experimental Investigation Concerning the Increased Secretion of the Intestine in Dogs, in the Presence of Obstruction of the Bowel.—Boese and Heyrovsky (*Deut. Zeit. f. Chir.*, 1909, cii, 183) says that recent works on ileus have made it probable that the majority of deaths from ileus are due to intoxication. There has been found in the fluid contents of the intestine a toxic substance which was capable of killing in a short time the animals experimented on. In the formation of these substances the bacteria play the chief role, and the increase of bacteria goes hand in hand with the liquefaction of the intestinal contents. Boese and Heyrovsky carried out experiments on dogs, the chief object of which was to determine the causes of the liquefaction of the hard fecal masses in the large intestine. After tying off the lower part of the large intestine in dogs, the hard, dry fecal masses were changed into a pulpy mass. This change was due to an increased secretion of the mucous membrane, beginning at the site of the ligature. The fluid contents of the lower, large intestine after the placing of the ligature, developed in the large intestine itself, and was not, as Talma has stated, the result of the accumulation in the large intestine of the secretion of the stomach and small intestine. The mucus secreted by the ligated portion of the large intestine is a poor culture medium for intestinal bacteria. Soon after the appearance of the transudate in the lumen of the bowel the bacteria grow rapidly, and through their influence the fecal masses are softened. The damage to the bloodvessels of the mucosa and submucosa of the intestinal wall, giving rise to the transudate in the lumen of the intestine, is to be traced to the influence of the stagnating intestinal contents. The formed feces are liquefied directly through the rapidly increasing bacteria, that is, through the gas formation which they cause. Atropine does not influence materially the secretion of the glands of the large intestine nor the liquefaction of the bowel contents in intestinal obstruction.

Statistics on Sarcoma of the Extremities.—Piperata (*Deut. Zeit. f. Chir.*, 1909, cii, 195) says that he could not find in the literature large collections of cases of sarcoma of the extremities. The largest was that of Gross (165 cases) reported in 1879. Piperata reported 142 cases from Hochenegg's surgical clinic in Vienna, admitted between 1894 and 1907. Of these, 46 involved the soft parts, 21 the skin, 19 the fascia, 5 the muscles, and 2 the nerves. Of the bones, the f mur was involved most frequently (30), then the tibia (13), pelvis (13), scapula (7), fibula (6), bones of the hand (5), clavicle (3), radius (1), and ulna (1). In 4 cases the fascia and bones were involved together, and in 5 cases the origin was not established. According to the statistics of Nasse also, the femur was most frequently involved. According to those of Reinhardt, the femur and tibia were involved with equal

frequency. Of the sarcomas of the long hollow bones in Piperata's statistics, 18 were periosteal and 13 myelogenous. The rigin of 29 was not determined. Nasse found 19 myelogenous and 21 periosteal, while Reinhardt found 30 myelogenous and 15 periosteal. Sarcomas of the extremities occur at all ages, most frequently between fifteen and thirty-five years, more rarely in the very old and in children. Males were attacked much more frequently than females, and this agreed with the findings of Reinhardt. Of 83 of Piperata's cases occurring in men, 42 involved the long bones; and of 58 cases in women, 19 were in the long bones. As for the age, there was no essential difference between men and women. Concerning the etiology, it was worthy of notice that 38 patients traced the origin of the growth to a trauma. More than half of these cases were sarcomas of the long bones. There was no evidence of an hereditary influence in any of the cases, although two cases occurred in sisters. The duration of the disease preceding operation varied much. About half of the cases had existed between five months and one year, 25 were in the first three months, 30 were between one and five years, and 3 were said to have existed for over five years. The operation performed in most of the cases was radical, that is, a high amputation in the diseased bone or an exarticulation in the joint above. After this operation recurrence at the site of operation occurred in only one case. Resection of the involved bone was followed by a permanent cure in one case. In another the same operation was followed by local recurrence, requiring an enucleation twenty months after the first operation. Extirpation of the tumor from long bones was without success, except in one case, in which a second extirpation was followed by healing. Three cases were later saved by amputation, and in 3 cases the outcome was not learned. Of the 142 cases, 26 are known to be alive, and 88 are known to be dead. The result in the remaining 28 is not known. Of the 26 living patients, in 1 recurrence is said to have taken place; in 10 the period since the discharge from the hospital, not yet four years, is too short to permit definite judgment concerning the success of the operation. A permanent cure has taken place in 15 cases. Two cases have remained well for fourteen years, 6 cases for thirteen years, 2 for twelve years, 1 for eleven years, and 4 for four years.

THERAPEUTICS.

UNDER THE CHARGE OF

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The Treatment of Gastric Ulcer.—Von Leube (*Deut. med. Woch.*, 1909, xxii, 961) describes his routine treatment f gastric ulcer: (1) Absolute rest in bed for from one to two weeks. This relieves the pain and promotes the healing of the ulcer. After the tenth day the

patient should lie down two hours after dinner. (2) One glass of tepid Carlsbad water twice a day. (3) The application of hot stupes to the epiga trium, renewed every fifteen minutes during the daytime. At night a wet linen cloth is substituted. (4) A light diet of high nutritive value and easy digestibility.

In the severe hemorrhagic cases von Leube puts the patients to bed, gives one dose of 30 drops of a 1 to 1000 solution of adrenalin and an injection of morphine to quiet peristalsis, and complete abstinence of food by the mouth. He substitutes an ice-bag for the hot stupes and gives bismuth. When the stool shows no longer the presence of blood and there are no other signs of hemorrhage he cautiously commences a liquid diet. He replies to Lenhartz that while eggs and milk may bind the acid, at the same time they cause the secretion of more acid and increase the peristaltic movem nts of the stomach. He does not give iron because he says ulcer patient; do not tol rate it well. Von Leube adds that a study of 25 cases on the liquid diet for two weeks did not show any marked reduction in the hemoglobin. He warns against the use of laxatives. By this routine method he has reduced the mortality from 13 per cent. in his first published series of cases to 0.5 per cent. in the present series. He reports in all 627 cases treated by this method. In 547 non-hemorrhagic cases 90 per cent. were cured, with no deaths. Most of these cures were effected in f om four to five weeks. In the remaining 80 cases 90 per cent. were cured and there was 2.5 per cent. mortality. In his entire series 90 per cent. were cured, 8.5 per cent. improved, and in only 1 per cent. was there failure to improve. Von Leube says that while the Lenhartz diet may be given without much danger, yet he believes that a more restricted diet is safer. He also emphasizes the necessity of a complete abstinence from food during and immediately following a hemorrhage. In addition he states that while his patients may lose in weight at first, they have more than made it up by the end of he second week.

The Present Status of the Serum Therapy of Epidemic Cerebrospinal Meningitis.—FLEXNER (*Jour. Amer. Med. Assoc.*, 1909, liii, 1443) gives a brief statement of the status of the serum treatment of epidemic meningitis. The serum has now been extensively used in Great Britain, France, Germany, the United States, and Canada. Lately there has been a severe epidemic in France, and the serum has been employed in the treatment. The mortality in the e cases will probably be less than 25 per cent. Flexner says that the serum treatment has bee n subjected to tests under a variety of conditions, some of which were as severe as probably ever occur, but yet he still advises caution in concluding that the case has been proved for the serum. He gives the results in 712 cases of epidemic meningitis treated with the serum, by different observers. Of the 712 cases, 224 died, a mortality of 31.4 per cent. The highest mortality occurred in the first two years of life and equaled 42.3 per cent. The second age period is from two to five years, in which the mortality was 26.7 per cent. The third age period embraces children from five to ten years of age, and gave the lowest mortality of all, namely, 15.9 per cent. The next period extends from ten to fifteen years, and gave a mortality of 27.7 per cent. The next period, of from fifteen to twenty years, showed a considerable rise

in mortality, equaling 32.7 per cent., and the last period, embracing the cases of twenty years and over, gave a mortality of 39.4 per cent. Flexner calls attention to the importance of early injections of the serum. Of those cases in his series injected during the first three days of the disease, the mortality was 25.3 per cent. Those injected from the fourth to the seventh day showed a mortality of 27.8 per cent., while those injected later than the seventh day gave a mortality of 42.1 per cent.

Intravenous Injections of Antidiphtheritic Serum.—SCHREIBER (*Münch. med. Woch.*, 1909, xxxi, 1597) was induced to try intravenous injections of diphtheria antitoxin in serious cases of diphtheria by the results of the experiments of Berghaus. He has thus treated 20 cases of diphtheria, with only 1 death. This fatality occurred on the thirteenth day of cardiac paralysis. The child aged ten years received a subcutaneous injection of 2000 units and on the following day was much worse. Schreiber then injected intravenously 4000 units of antitoxin, which caused some improvement, but on the eighth day the heart became involved, and five days later the patient died. He is in favor of giving single high doses, 6000 to 10,000 units, rather than to repeat the dose in order to avoid a possible anaphylaxis. He thinks that high doses by infusion lower the temperature more rapidly than the subcutaneous injections. At the same time the general condition improves more rapidly. However, he believes that the intravenous injections do not have as good an effect on the local process. Schreiber says that if an intravenous injection is for any reason impossible, an injection deep into the gluteal muscle is more rapidly absorbed than a subcutaneous injection. He adds that high doses injected intravenously combine more surely with the toxins and are more apt to prevent paralytic complications.

Tuberculin Treatment Among Dispensary Patients.—HAMMAN and WOLMAN (*Bull. Johns Hopkins Hospital*, 1909, xxi, 225) write concerning the tuberculin treatment of dispensary patients. They believe that tuberculin may be used in the dispensary without danger and with the most satisfactory control. All dispensary patients are not suitable for the tuberculin treatment. A degree of intelligence is essential, the patient must be willing to undergo a long and often tedious cure, and must be faithful in carrying out instructions. A certain amount of home comfort and enough leisure to allow regular attendance at the dispensary are required. The early cases are much more favorable for the treatment, but in their series Hamman and Wolman took all stages. Most of the women did some work at home, and some of the men worked more or less constantly throughout the whole period of the treatment. They furnished the patients with note books in order to be more sure of their coöperation. A visiting nurse to instruct and supervise the patients is essential. The patients were kept in bed whenever they had fever either occurring spontaneously or as a result of the tuberculin injections. Fever of a mild grade when other symptoms are favorable they do not consider a contra-indication to the treatment. In addition to the tuberculin the usual hygienic and dietetic measures were ordered. Some of the patients were given olive oil,

tonics, and a few had heroin and codeine for their cough, when severe. Hamman and Wolman believe that the potency of all the tuberculins depends upon the same substances and that all act in the same way. They used old tuberculin, new tuberculin, T. R., and the bouillon filtrate of Denys. Fresh dilutions were made every two weeks, and apparently the strength remained uniform during this time. They emphasize that the injection must be subcutaneous in order to determine any subsequent local reaction. They give the tuberculin in gradually increasing doses, as advocated by Trudeau, Denys, and Sahli. The initial dose is from 0.00000001 to 0.000001 gram. In the smaller doses they give injections twice a week; after 0.01 gram is reached only once a week. The essential feature of this method is to avoid the occurrence of any reaction and to carry the individual patient only as high as his tolerance will permit. The signs of developing intolerance may be expressed by a rise of temperature, constitutional symptoms, a local reaction at the site of injection, or a focal reaction, that is, an increase in the tuberculous process as measured by an increase in the physical signs or symptoms. After a moderately severe or severe reaction ten to fourteen days should elapse after all symptoms of the reaction has subsided, and then much smaller doses should be used. If a local reaction occurs the same dose is repeated until no local reaction occurs. If, on the other hand, the local reaction becomes more severe, the dose is decreased and then cautiously raised. The average maximum dose of tuberculin was 0.005 gram. The largest dose administered to an individual case was 1 gram. The early cases and those that do well take the largest dose. The far-advanced and progressive cases reach the limit of tolerance early. The duration of the treatment is based rather on the progress of the case than on the condition at the beginning of the treatment. The total number of patients who received the tuberculin treatment was 112. Hamman and Wolman report only those who were under treatment at least ninety days, a group of 71 cases; 14 of these 71 cases were not positively pulmonary tuberculosis, although probably so. They all improved as regards their tuberculous symptoms and the suggestive physical signs disappeared. The 57 remaining cases were divided into 13 incipient, 16 moderately advanced, 28 far advanced. Of the 57 patients, 10 were apparently cured, in 16 the disease was arrested, 12 were improved, 18 were progressive, and 1 far advanced case died. Of the 18 progressive cases, 4 improved as regards symptoms, 10 were unchanged as regards symptoms, and 4 far advanced cases were worse as regards symptoms. Of the 13 incipients, only 1 was progressive; of the 16 moderately advanced, 2 were progressive; of the 28 far advanced, 16 were progressive. The average gain in weight for the entire group was six and one-half pounds. The maximum gain in weight was forty-one pounds, and occurred in a far-advanced case.

The Lowering of Blood Pressure by the Nitrite Group.—WALLACE and RINGER (*Jour. Amer. Med. Assoc.*, 1909, xx, 1629) have made some observations in order to determine the comparative effect of the most common drugs of the nitrite group upon the blood pressure of normal individuals and of patients with arteriosclerosis. In order to obtain uniformity of results they gave amyl nitrite in dosage of 3 minims by

inhalation; nitroglycerin, 1.5 minims of a 1 per cent. solution; sodium nitrite, 1 grain in solution; and erythrol tetranitrate, 1.5 grains in chocolate tablets. The latter three were given by the stomach. All of these drugs, in the doses above given, seemed to cause the same fall of blood pressure in normal individuals. The chief difference in their action lay in the rapidity and the duration of the fall of blood pressure. They found that the action of amyl nitrite began within one minute and was over within seven minutes; that of nitroglycerin began within two minutes, and was over within thirty minutes; that of sodium nitrite began within ten minutes, and was over within one hour; that of erythrol tetranitrate began within fifteen minutes, and was over within two to four hours. In general they found that the higher the initial pressure, the greater was the actual fall. Increase in dosage produced an increase in degree and duration of the action which is, as a rule, fairly proportional to the dose. In studying the effects on abnormally high blood pressures they took patients suffering from arteriosclerosis with pressures varying from 172 to 256 mm. Hg. They gave the following doses, $\frac{1}{30}$ grain of nitroglycerin, 2 grains of sodium nitrite, and 2 grains of erythrol tetranitrate. On compar ng the results obtained in normal individuals with the re ults in arteriosclerotic patients, they found them very similar. Nitroglycerin had the same effect upon arteriosclerotic patients as upon normal individuals. Sodium nitrite and erythrol tetranitrate acted a little less quickly, the maximum effect came a little later, and the duration of action was slightly longer than was the case with normal individuals. Wallace and Ringer obtained a fall of blood pressure in every case. They believe that the fall of pressure is due to a dilatation of the splanchnic vessels, and that a failure is due to the fact that the splanchnic vessels are no longer capable of dilatation. They also discuss the question of the best form in which nitrites should be given, and whether they deteriorate in activity by keeping. Amyl nitrite, as usually supplied in glass pearls, keeps well if not exposed to the light. Nitroglycerin tablets may retain their activity for a year or more. However, the content of nitroglycerin in fresh tablets may vary considerably, and it is best to make use of a solution of nitroglycerin. A 1 per cent. solution keeps fairly well, and is the most reliable as regards uniformity of strength. Solutions of sodium nitrite deteriorate rapidly. A solution should not be used which is over a week old. Matthew states that ordinary tablets of erythrol tetranitrate are usually inert, but that the full activity is retained by coating the tablets with chocolate. Wallace and Ringer have found that even after keeping for one year these tablets retain their full activity.

The Treatment of Pertussis with Eucalyptus.—Soldin (*Klin.-Therap. Woch.*, 1909, xxix, 722) says that eucalyptus leaves have been advocated for a long time in the treatment of various respiratory diseases, especially asthma and chronic catarrh. A disinfectant and a sedative action have been ascribed to the ethereal oil contained in the leaves. Danielus and Sommerfeld advocated the vaporization of the leaves in the treatment of tuberculosis. Other authors doubt i s efficacy, but it does seem to diminish both the cough and expectoration. Soldin made use of two commercial preparations of eucalyptus leaves, sanosin and sydrosin, in the treatment of pertussis. He treated 26 cases in all, and

found it lessened the number and severity of the paroxysms in most of the cases. Three of the patients failed to receive any benefit from the treatment. Soldin found that this treatment was of especial value when there was a marked bronchitis or when there were indications of a complicating bronchopneumonia. He does not believe that this method is specific, but thinks it does diminish the severity and length of the disease. He advocated its use because it may be given with perfect safety.

PEDIATRICS.

UNDER THE CHARGE OF

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The Treatment with Lactic Acid Bacilli of Infantile Diarrhœas Due to Intestinal Fermentation.—C. H. DUNN (*Jour. Amer. Med. Assoc.*, 1909, liii, 5599) believes in an etiological classification of infantile diarrhœas. There are four fundamental etiological factors: (1) Nervous influences; (2) indigestion; (3) bacterial fermentation; and (4) bacterial infection. He states that true bacterial infection is caused by parasites, which live in and on the tissues of the body, whereas bacterial fermentation is caused by saprophytes living in and on the intestinal contents. The treatment of the two conditions is absolutely different, the former cases yielding to serotherapy and vaccine therapy, the latter to other methods. Dunn quotes Tissier, who found that Bacillus perfringens is the cause of fermental diarrhœa, and that the lactic acid bacillus stopped its development. He, therefore, gave such patients pure cultures of this bacillus, noting rapid transformation of their stools, subsidence of their symptoms, and gain in weight. For this same purpose Dunn employed unpasteurized buttermilk, believing that it would contain large numbers of these bacilli. The buttermilk selected was first pasteurized to kill all other organisms, then inoculated with a pure culture of lactic acid bacilli, and ripened until the development of the organism had brought about the proper acidity and precipitation of the casein. Of 28 cases of fermental diarrhœa thus treated, 23 recovered completely, in 3 the treatment was partly successful, while in only 2 did it fail. The cured cases lost their diarrhœa, and gained weight rapidly. All these babies had failed to improve on routine treatment, and also when fed on pasteurized buttermilk; the recovery, therefore, cannot be due to the chemical peculiarities of the food, but to the only new element added, the lactic acid bacilli. In a number of the children, to assure a steady gain in weight, the patient had to be given alternate feedings of modified milk, thus suggesting that while buttermilk can check the fermentation, it is not suited to the caloric needs of the child. In all the cases the buttermilk was stopped as soon as the diarrhœa was checked, and the food employed previously was resumed. In four cases ripened milk could not be digested; they

were given pure cultures of lactic acid bacilli with excellent results. When pure cultures are added to modified milk, the success is much greater if all the fat has been removed from the milk previously. He concludes that the lactic acid treatment is of great value in fermental diarrhœas, that it is not absolutely a specific treatment; the failures may be due to an ineffective lactic acid bacillus; it should be tried in every case of infantile diarrhœa characterized by saprophytic fermentation, and in every case of chronic intestinal indigestion and atrophy in which the movements show fermentation. A ripened milk containing living bacilli he considers the best food with which to begin feeding in cases of fermental diarrhœa after the initial period of starvation.

Adeno d Hypertrophy during the First Year of Life, and its Treatment.—R. G. FREEMAN (*Jour. Amer. Med. Assoc.*, 1909, liii, 605) emphasizes the following symptoms as pointing to the existence of adenoids: Snuffles, snoring, mouth breathing, recurrent colds, cough, and otitis media. He describes his method of examining infants for adenoids, and states that a chronic enlargement requires but one typeof treatment—operative procedure. The operation in infancy can be done quickly without an anesthetic, with very little shock to the child and with no lasting fright. If an anesthetic is insisted upon, it should be nitrous oxide, and only primary anesthesia should be produced. The operation may be performed as early as the fourth to the fifth month.

Suppurative Conditions in the Joint Regions in Infants and Young Children.—L. E. LA FETRA (*Jour. Amer. Med. Assoc.*, 1909, liii, 608) comes to the following conclusions: (1) Cases of arthritis and of what might be called "near arthritis" are quite common in infants and young children. (2) In all cases a careful history of the infant from birth should be obtained. The inquiry should be directed particularly toward obtaining a history of umbilical infection, of early ophthalmia, of vaginitis, of pneumonia, typhoid, and influenza. (3) The feeding history, especially the use of sterilized, carbohydrate, or proprietary foods, should be carefully scrutinized. An inspection of the gums may save an incision into the thigh. It goes without saying that the patient should be undressed entirely for examination. Men frequently fail in diagnosis, not because they do not know, but because they do not see the patient, and do not make use of what they know. (4) The diagnosis of tuberculosis and rheumatism should be made by exclusion. (5) The earlier proper treatment is instituted the fewer the number of joints involved and the greater the chance of complete recovery of function. He advises dressings of aluminum acetate or of 60 per cent. alcohol in all early cases, but if progress is not satisfactory, the joint must be incised, evacuated and drained; if there is bone disease, the bone must be scraped. Vaccine therapy, especially the use of streptococcic and staphylococcic vaccine, is often a very valuable aid.

The Secretion of Gastric Juice in the Pathogenesis and Course of Pyloric Stenosis of Nursing Infants.—In contradistinction to other observers, ENGEL (*Deut. med. Woch.*, 1909, xxxv, 1271) believes the first change, and the most important probably, in the genesis of a stenosis of the

pylorus to be a secretory disturbance of the stomach. This is neither a hyperacidity nor a hyperchlorhydria, but rather a gastrosuccorrhœa, a formation of true gastric juice. The presence of gastric juice in the empty stomachs of nursing infants he considers a sign of disease. Simultaneous with this flow of gastric juice there is a spastic closure of the pylorus. Whether due to the same cause that induces the flow of gastric juice and occurring simultaneously, or whether occurring secondarily to it, cannot be definitely decided. The latter seems the more probable. After this acute stage of excessive secretion has passed off, a chronic and non-spastic narrowing of the lumen of the pylorus remains, and this disappears only very slowly. At this time signs of stasis make up the chief part of the clinical picture. The stasis of fat first pointed out by Tobler, is an especially characteristic sign of retention. The cause of the condition, therefore, lies in an extraordinary hyperexcitability of the gastric mucosa. Engel publishes the details of two cases, which form the basis for his conclusions.

Noma of the Ear, Terminating in Recovery.—O. Homuth (*Deut. med Woch.*, 1909, xxxv, 1276) reports the case of a child, aged fifteen months, in whom, for some time prior to the onset of measles, there existed a suppurative otitis media. Two weeks after the onset of measles the discharge from the ear became more marked and assumed a bad odor; a few days later an ulcer formed in the auditory canal and the auricle became necrotic. In the course of the next few weeks the gangrene continued to spread until the entire auricle had been removed, the middle ear cleaned out, and a part of the parotid gland cut away. The sudden appearance, the acute course, the absence of pain throughout, and the absence of syphilitic signs made a diagnosis of syphilis or tuberculosis, the only other diseases to be considered, impossible.

The Feeding of Immature and Atrophic Infants.—Poor fœtal development, according to A. G. Spalding (*Jour. Amer. Med. Assoc.*, 1909, liii, 998), may be the result of heredity or of anemia or toxemia, such as is due to syphilis, alcoholism, poverty, gonorrhœa, nephritis, heart disease, and tuberculosis. Appropriate treatment of the mother during pregnancy may prevent an immature or atrophic state at the time of birth. Such infants are very much in need of mother's milk, as this possesses certain inherent properties, which aid the action of the "hormones," whose function it is to stimulate the different digestive ferments. If mother's milk is not available, feeding should be carried on with due regard to the avoidance of food intoxication, which favors failure of development; excess of fat is most likely to cause food intoxication. Spalding has devised a method, which is described by him in detail by means of a chart. It has been successful in his hands in the treatment of such infants; when he adds fats to the diet, he watches the infants carefully, reducing it at the first signs of indigestion.

Vaccine and Serumtherapy in Children.—Vaccine therapy produces an active immunity to the specific bacteria, while serum therapy produces a passive immunity only. C. F. Kerley (*Jour. Amer. Med. Assoc.*, 1909, liii, 1179) reveals the results of the two types of treatment in children; the former has given the better results in staphylococcic

infections; the inoculations, varying from 7,000,000 to 50,000,000 of bacteria, depending upon the child's age, should be repeated every sixth to tenth day, the opsonic index being the criterion as to when the injection should be repeated. In furunculosis and acne excellent results have been obtained by this method of treatment. Streptococcic infections do not yield so readily; the injection dose is about one-third of the staphylococcic. The course of erysipelas is shortened by the injection of staphylococci; scarlet fever has not been influenced at all. In local streptococcic inflammations, such as adenitis, otitis, osteomyelitis, encouraging results have been obtained by the treatment. Gonococcic injections in vulvovaginitis have been without results, as have been pneumococcic injections in cases of pneumonia; but pneumococcic empyema has been distinctly improved by vaccine injections. Flexner's serum is of greater advantage in cerebrospinal meningitis than mere vaccination. Cystitis due to Bacillus coli communis is shortened by inoculations with dead colon bacilli. Tuberculin is of value in chronic local tuberculosis, without constitutional symptoms (bone, joint, gland, skin, and eye infections), and in chronic pulmonary tuberculosis; but in lesions associated with signs of fever, the injection of tuberculin is harmful.

OBSTETRICS.

UNDER THE CHARGE OF

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Methods of Operation in Deficient Dilatation of the Cervix.—One of the last papers written by PFANNENSTIEL is upon this subject, published in *Monatschr. f. Geb. u. Gyn.*, 1909, xxx, Heft 5. He urges upon the general practitioner the use of elastic bags in cases in which dilatation of the cervix is not greatly hindered by the presence of scar tissue. Should this be present, he advises multiple incisions for 2 or 3 cm. When, however, the cervix has not been shortened, he would advise abdominal Cesarean section in cases in which the mother's life is threatened, as he considers this safer than the use of Bossi's dilator. When the mother's life is not in danger, and yet the indication is to dilate the womb and empty it, he prefers the use of bags to that of a metal dilator. He regards as especially demanding delivery, eclampsia, fever occurring during labor, and prolapse of the umbilical cord. In placenta prævia he states that the results of combined version have been a maternal mortality of from 9 to 10 per cent., and a fœtal mortality of 81 per cent. to 62 per cent. in vigorous children. If an elastic bag be introduced through the placenta and then distended, delivery can be effected, with a maternal mortality of but 5 per cent., and from 25 to 42 per cent. mortality for the children.

He warns against active measures for delivery in patients that have

suffered from very severe hemorrhage, and would choose that method which would control the hemorrhage with the least disturbance to the mother. In many of these cases abdominal extirpation of the uterus gives the best chance. He compares them to ruptured ectopic gestation.

Acute Lysol Poisoning from Irrigation of the Uterus during Suprasymphyseal Cesarean Section.—BIRNBAUM (*Zent. f. Gyn.*, No. 44, 1909) reports the case of a multipara with a flattened pelvis, who was operated upon by suprasymphyseal section. After the uterus was opened the child was readily delivered by external pressure. The amniotic liquid had an offensive odor, and after the placenta was delivered the uterus was irrigated with two quarts of 0.5 per cent. lysol mixture. The uterus was then sponged to remove the excessive fluid. There was no evidence that air entered the vessels at the placental site. While sutures were being introduced the patient's pulse became very slow, and the breathing slow, superficial, and attended with rales. Under massage of the heart and artificial respiration the patient's condition improved. Half an hour afterward the symptoms again appeared, and were followed by death. Postmortem examination was entirely negative. The heart muscle showed a very faint trace of fatty degeneration. The case is considered to be one of acute and fatal poisoning with lysol by the irrigation at the site of the placenta. It is thought that the raised position of the pelvis favored the accident and that it brought the fluid more immediately in contact with the upper portion of the uterine cavity.

This same coincidence has been observed in other cases in which intoxication with lysol occurred, the patient having been operated upon with the pelvis raised. This accident naturally suggests the caution that with patients in this position the uterus should not be irrigated, but if necessary should be sponged with sterile gauze.

The Interruption of Pregnancy for Pulmonary Tuberculosis.—ALBECK, of Copenhagen, and RODE, of Christiana (*Zent. f. Gynäk.*, No. 44, 1909) contribute a paper upon this subject to the Norwegian Surgical Society in its gynecological section.

In Meyer's clinic in Copenhagen, 82 cases of pulmonary tuberculosis complicated by pregnancy had been observed; 28 of these had phthisis before the beginning of pregnancy, and the disease showed no increase during pregnancy; in the puerperal period 19 of these had fever, and with 4 the disease made evident progress. None of them died of the tuberculosis. Among the remaining 54 the first symptoms of tuberculosis appeared during pregnancy, or a previous infection became acute during this time; 15 of these died of pulmonary tuberculosis soon after delivery; 12 showed marked increase in the pulmonary lesions during the puerperal period; 11 among the 54 had tuberculosis of the larynx, and of these 6 died.

In a private sanitarium, 19 patients having tuberculosis were observed during the pregnant condition. Among these 16 were followed through pregnancy and the puerperal period, and of these it was found that 6 died within a year and a half after the birth of the children.

The tuberculosis seemed aggravated not earlier than the fifth month

of gestation. It was difficult to base a prognosis, as some patients did not seem at first to be unfavorably influenced by pregnancy.

As regards the influence of pulmonary phthisis in producing abortion, 1194 cases of early abortion were examined, and in none of them could phthisis be recognized as the cause. In 17 of the 82 cases studied, pregnancy went to within four weeks of full term. In the remaining 65 pregnancy went to the utmost limit.

So far as the children were concerned, 8 were stillborn—one from deformity, 3 because premature, and 4 after difficult delivery. While the mothers were in the hospital 4 others died; the remaining were discharged in good condition, and some of the children were above the average in weight and development. An effort was made to trace these children afterward, and 38 of them were followed through the first year of life; 13 of these died; the remaining 25 were healthy at the end of the first year.

The conclusion of these investigations seems to be that pulmonary tuberculosis rarely if ever causes abortion and very seldom brings on premature labor. Its effect upon the children seems to be less than many have supposed.

Moller had been averse to the interruption of pregnancy in cases of pulmonary tuberculosis, but the results of non-interference had been exceedingly bad. Not less than 58.3 per cent. of his patients died within a year after the birth of the children, and but 25 per cent. of them passed through labor without growing worse.

Of those becoming pregnant and having pulmonary tuberculosis, 50 per cent. died, or were made very much worse. This experience has led him to believe that pregnancy should be interrupted in this condition.

Suprasymphyseal Cesarean Section.—RUNGE (*Archiv f. Gynäk.*, 1909, lxxxix, Heft 2) reports 22 cases of suprasymphyseal Cesarean section in Bumm's clinic. He considers Latzko's method to be more simple and practical than Sellheim's, and believes that by this method the danger of wounding the peritoneum is reduced to a minimum.

As an aid to recognizing the position of the bladder, a catheter may be introduced into the bladder before the operation. A transverse incision through the abdominal wall gives the best view of the field of the uterine opening. In 9 of the 22 cases the peritoneum was injured to some extent, and 8 of these were operations performed after Sellheim's method. There were small lesions of the bladder in 3 cases; 2 of these were Sellheim's operation and 1 Latzko's method.

The uterine cavity was opened by a longitudinal incision, but considerable hemorrhage from the uterine wound was not observed. It was not necessary to enlarge the uterine incision to extract the child.

In 14 cases the vertex of the fetal head presented; the forceps was used twice—once in abnormal presentation, and once in face presentation. In 4 cases in which the vertex presented the head could not be pressed down sufficiently for extraction, and version was performed. In one case the presentation was that of the breech and the feet. The forceps should not be applied until anterior rotation of the occiput has been performed by the hand, if necessary.

All of the children were delivered alive, some of them slightly asphyxi-

ated, but easily resuscitated. There were no complications in the delivery of the placenta, and in most cases the operator was not obliged to hurry this stage of labor. The placenta was expressed by Credé's method, or removed by the hand, as seemed necessary. In 2 cases the connective-tissue region of the pelvis was drained after operation, as in one case cocci and bacteria were found in the amniotic liquid. In 19 patients the puerperal period was without noticeable complications. In 6 patients pus formed in the abdominal incision; one of these patients suffered from pneumonia, bronchitis, and angina. In 3 patients there were severe complications during the puerperal period; one had phlegmonous inflammation of the connective tissue of the pelvis; and two of these patients died.

The mortality rate of the mothers was 9.1 per cent. Among these was one case of eclampsia. The mortality rate of the children was nil.

In 15 cases the patient was discharged with the uterus anteflexed and movable; in one patient anteflexion was present, but the uterus was adherent to the abdominal wall. This operation was performed after Sellheim's method, and was a difficult operation, with injury to the peritoneum. In one case there was complete retroflexion, and the cervix was adherent to the abdominal scar. This patient had phlegmonous inflammation of the pelvic connective tissue, but recovered.

At the time of writing, 2 cases were still under treatment, and 2 patients had died. There were some cases of hernia in the scar, adhesions to the anterior cervical wall and the abdominal wall, and the development of scar tissue in the connective tissue of the pelvis. As a rule, however, the results of the operation seemed favorable.

The question naturally arises, What would be the fate of such a patient in subsequent labor? The scar is left in that part of the uterus which is subjected to the severest pressure during parturition, and the natural fear would be that rupture of the uterus at this point might develop.

GYNECOLOGY.

UNDER THE CHARGE OF

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The Preparation and After Treatment of Celiotomy Cases.—S. E. Tracy (*Surg., Gyn., and Obst.*, 1909, viii, 645) minutely considers the preparation and after-treatment of celiotomy cases, offering several valuable suggestions. One notable feature in Tracy's preparatory treatment is the careful inspection of the buccal cavity and prophylactic treatment of it. This consists in applying to the teeth and gums some preparation of silver in solution, followed by spraying under high pressure with full strength peroxide of hydrogen. Mouth cleansing is a feature of both the preparation and after-treatment. Tracy gives morphine and atropine

hypodermically an hour before the anesthetic is administered, but positively shuns the employment of these analgesics for postoperative pain. In the treatment of shock the remedies long discarded by many are still commended. Among these are alcohol, strychnine, etc.

Cancer of the Cervix Uteri Following Subtotal Hysterectomy.—REYMOND (*An. de gyn. et d'obst.*, 1909, xxxvi, 117) reports a case of cancer of the cervix following by some years a subtotal hysterectomy. Reymond found the cancer was so extensive that an abdominal operation seemed necessary and was performed for removal of the disease. The case was used as an argument for total instead of subtotal hysterectomy.

Abnormal Secretion from the Mammary Glands.—G. GELLHORN (*Jour. Amer. Med. Assoc.*, 1909, lii, 1839) holds that physiological experiments have demonstrated the specific function of the mammary gland is independent of the nervous system. But Gellhorn insists that certain moot questions concerning the functions of these glands require further careful observations. After referring to demonstrations of lacteal secretion occurring in pregnancy, the puerperium, the newly born, the growing child, the adult virgin, and the old woman, he offers reasonable evidence that it may be prolonged indefinitely after childbirth and may be associated with certain pathological conditions within the genital sphere. Aside from the intense scientific interest in the genesis of lacteal secretion, Gellhorn believes there is considerable practical importance attached to abdominal activity of the mammary glands, and a thorough knowledge of the atypical function of these organs is indispensable to the expert in medicolegal practice.

The Significance of Peritoneal Adhesions Following Operations.—H. T. BYFORD (*Surg., Gyn., and Obst.*, 1909, viii, 576), in his paper read before the American Gynecological Society, stated that much of the difficulty from peritoneal adhesions following operation is a result of "the postgraduate, looking on" course in general surgery, which is thought to be or pretended to be a sufficient preparation for an unlimited indulgence in peritoneal surgery, and, consequently, many operations for the relief of the adhesions resulting from such imperfect operations. Byford recommends the slightest amount of handling of the peritoneum and the frequent employment of drainage in pelvic operations, using either the abdominal or the vaginal routes. He prefers the glass tube for drainage through the abdominal wall and gauze for drainage through the vagina.

Tuberculosis of the Gland of Bartholin.—LECÈNE (*An. de gyn. et d'obst.*, 1909, xxxvi, 77) failed to find reported a single case of tuberculosis of the Bartholin gland in the literature of gynecology of the past twenty years, and attributes its great rarity to the absence of histological study of chronic inflammation of this structure. He refers to the case of tuberculosis of Cowper's gland found by Hartmann and himself in 1903, and Hallé's subsequent systematic examination of the specimens of Cowper's glands in the Museum of Guyon à Necker, which resulted in the discovery of tuberculosis in many specimens. He expresses his belief that the same result would be found with the specimens of Bar-

tholin's glands. Lecéne has observed two cases of tuberculosis of Bartholin's gland. The first was of a woman, aged forty years, on whom Dujarier did an abdominal hysterectomy, he having diagnosticated cancer of the cervix uteri. That diagnosis seems erroneous, as sixteen months later a nodule appeared on the labium that, on extirpation and microscopic examination, proved to be a tuberculous Bartholin gland. The second case occurred in a woman, aged twenty-three years, who applied for treatment of large masses in the groins. An ulcer was found in the vulva that involved a Bartholin gland and an anal fistula. Believing the vulvar ulcer was syphilitic, a bacteriological study revealed tuberculosis, and exsection of the pathological lesions in the three sites mentioned resulted in cure.

Local Anesthesia in Dilatation of the Cervix and in Cervical Operations.—Otto Henrich (*Zentralbl. f. Gynäk.*, 1909, xxxiii, 524) employs a 1 per cent. solution of β-eucaine to which sodium chloride and a trace of adrenalin has been added in producing local anesthesia in cervical dilatation and in operations on the cervix. The needle of the syringe is introduced into the cervical tissue for 1 to 1.5 cm., and while it is being withdrawn a few drops of the solution are injected. He makes four injections, and, finally, injects a few drops into the cervical canal. After waiting at least five minutes dilatation is effected without producing pain. He employed this method in a large number of cases with excellent results. No bad effects were observed. When larger doses are used the quantity should not exceed two syringefuls.

The Influence of Corsets and High-heeled Shoes on the Symptoms of Pelvic and Static Disorders.—Reynolds and Lovett (*Surg., Gyn., and Obst.*, 1909, viii, 569) have carefully studied the effects of corsets and high-heeled shoes on the symptoms of pelvic and static disorders, and the conclusions reached are at wide variance with the teachings for generations. After patient study a method has been devised for determining the centre of gravity in any living person in any position, and it has been found that many of the symptoms of pelvic and of static conditions are due to the centre of gravity of the body being too far forward. It is also believed that many times pelvic conditions, such as inflammatory states, adhesions resulting from infectious inflammation, or uterine or other neoplasms, bring about the gravity displacement. Wearing of badly fitting corsets is a prolific cause of it. The backache and headache of women is found to result frequently from this gravity displacement. Reynolds says most corsets do not fit properly unless made to order. It was found that a properly fitting corset not only is not harmful, but, *per contra*, puts the centre of gravity at the proper point, and relieves many of the symptoms thought to be due to gynceological ailments. Reynolds and Lovett also state that high-heeled shoes, while injurious to the feet, do not act injuriously upon the back as the centre of gravity, provided a properly fitting corset is worn at the same time.

OTOLOGY.

UNDER THE CHARGE OF

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Arterial Hypertension and Hypertension of the Labyrinth.—Lafite-Dupond (*Annales des maladies de l'oreille, etc.*, December, 1908, p. 739), by experiments upon anesthetized dogs, determined the fact that an increased intralabyrinthine pressure was followed by an increase also in the arterial pressure. The increase in labyrinthine pressure was effected in some cases by increased air pressure in the tightly stopped external auditory canal, and in other instances by the injection of normal salt solution into the labyrinth itself through the medium of the round window, the increased or decreased pressure of the cerebrospinal fluid being accompanied by corresponding variations in the blood pressure. The channels of communication between the labyrinth and the cerebrospinal space are the aqueductus vestibuli and the nerve sheath of the acusticus; these, however, are so inadequate as a medium of gross communication, that a rapid translation of pressure from the labyrinth fluid into the cerebrospinal space cannot be conceived; but, as it was observed that the blood pressure changed almost instantaneously in response to the intralabyrinthine pressure, the inference is at least permissible that the internal ear is an organ with a capacity to exert an influence on the blood pressure. The pathogenesis of increased intralabyrinthine pressure is a difficult question. If the hypertension in the labyrinth stands in relation to increased blood pressure, which pressure is primary and which the sequence of the other? Lafite-Dupond has observed that in all patients with labyrinthine hypertension increased blood pressure was observable, as contrasted with the fact that with a considerably increased blood pressure there was no evidence whatever of disturbance of the auditory function, with the exception of a decrease in the upper tone limit of audition, and a shortening of the duration of hearing by bone conduction. The symptoms accompanying, in a greater or less degree of severity and frequency, the labyrinth hypertension are subjective noises, disturbances of audition, otalgia, diminished hearing by bone conduction, and increased blood pressure, these symptoms being sometimes accompanied by headache and vasomotor disturbances. For local treatment the author recommends massage of the drumhead, with short excursions of the piston of the air pump, and for general treatment the subcutaneous administration of pilocarpine.

The Monochord and the Upper Tone Limit.—R. Wilberg (*Archiv f. Ohrenheilkunde*, 1909, lxxx, 83, 165) states that the first recorded investigations, as to the upper tone limit of audition, made by means of the monochord, were those of F. A. Schulze (*Annales de physiologie*, 1907) and J. Hegener (*Deut. Otolog. Gesellschaft*, 1908) both observers

making individual tests in comparison with the Galton whistle, tuning forks, and metal rods, preferentially in favor of the monochord as a controllable and reliable means of upper tone production. This instrument, as described by Schulze, consists of a length of slender steel or silver wire, preferably the former, fastened firmly at the two ends by means of clamps, and with an intermediate, movable clamp permitting definition of the vibration length of the wire, the production of the desired tone being effected by means of light longitudinal friction. For this actuation Schulze employed a small piece of leather, but Wilberg obtained better and more uniform results by the use of a wash leather glove, stroking the wire between the fingers, and later by using a strip of leather with a fish-tail slit in the end, the leather being drawn lengthwise of the wire with the apex of the slit rubbing upon the metal. The comparisons drawn between the test made with the monochord, and those including the upper limits of the Galton whistle served to confirm previous opinions in regard to the unreliability of the upper portions of the Galton scale, and emphasized the value of the monochord in such investigations as those undertaken by Wilberg to determine the upper tone limit of audition at different ages in the human subject. The conclusions drawn were to the effect that there is no generally determinable upper tone limit, that it is dependent upon the age of the individual and the strength of the tone employed, and that it is increased by accustomed use and decreased by conditions which represent a resistance to the passage of the sound waves, such as are presented in disturbances of the sound-transmitting apparatus.

Resistance Capacity of the Facial Nerve.—R. BARANY (*Archiv f. Ohrenheilkunde*, 1909, lxxx, 147) states that in a case of mastoiditis, in a tubercuous subject, without evidence of the implication of the facial nerve, an operation resulted in the removal of a large sequestrum, including the whole of the tip of the mastoid process and the anterior and inferior walls of the osseous external auditory canal, including the stylomastoid foramen. At but one point, in the lower portion of its course, was the facial nerve surrounded by normal bone, but, notwithstanding the extent of the sequestrum formation, the nerve was functionally intact. In the discussion which followed the report of the case here recorded, G. Alexander drew attention to the fact that the facial nerve is especially resistant to such injury as might accompany hemorrhage, contiguous inflammatory processes, the pressure incident to cholesteatoma formation, or the effects of a surrounding bony necrosis, the vestibular nerve being less resistant than the facial, and the first nerve to suffer injury being the cochlear branch. H. Frey reported a case of carcinoma in which the facial nerve was almost completely embedded in the growth without evidence of loss of function, and F. Alt reported the removal, as a sequestrum, of almost the entire labyrinth, in the course of a radical operation, in a case in which there had been but slight evidence of facial paralysis. According to H. Neumann the reason for the greater resistance capacity of the facial nerve was to be found not only in its structural characteristics, thicker fibers, and larger nerve cells, but also in the fact that its blood supply being derived from the stylomastoid artery, the labyrinth drawing its main supply from the internal auditory.

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

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The Blood-pressure-raising Substance of the Kidney.—A. BINGEL and E. STRAUSS (*Deut. Archiv f. klin. Med.*, 1909, xcvi, 476) report their careful observations on the blood-pressure-raising substance in the kidney in an interesting article. Tigerstedt and Bergman had previously shown the presence of a substance in watery extracts of rabbits' kidneys called rennin, which, when injected into rabbits, had a distinct blood-pressure-raising effect. Bingel and Strauss in their experiments used the pressed juice of fresh kidneys. Only the cortex corticis was employed, the pyramids being cut away and all blood washed out. The present investigation was carried out chiefly with extracts of pigs' kidneys, for Bingel and Strauss had previously shown that the extracts from kidneys of all large animals possessed the same effect, when injected into rabbits, as the extract from the kidneys of rabbits themselves. Tests were made with the juices of many other organs, but all save the hypophysis cerebri and adrenal gave depressor effects. The pancreas was especially noticeable in this respect. The action of the kidney juice was very powerful, for it produced a rise in pressure of from 40 to 60 mm. Hg. This lasted from one-quarter to one-half hour, and the descent was slow. Bingel and Strauss, moreover, were able to separate the active principle, which they call rennin, from the kidney extracts. Among other qualities they state that the activity of the substance is destroyed by heating to 58° C. and by the action of acids, alkalies, alcohol, and acetone. Physiologically it has precisely the same action as the whole kidney juice. After injection the effect is not immediate, but appears in about one-fourth of a minute. The rise in pressure is not extremely rapid, for it takes from one to two minutes to reach the highest point. The height is maintained for variable lengths of time and then there follows a gradual sinking in pressure. This decline usually requires from one-half to three-fourths of an hour. The maximum rise recorded in any of their experiments was 70 mm. Hg. A comparison of the action of rennin with that of adrenalin indicates that the former causes a much less sharp rise of pressure and permits a slower fall. Repeated injections of rennin produce progressively less effect, until finally there is no response. But this is not because the animal's blood-pressure-raising capacity is lost, for injection of adrenalin after a series of rennin injections causes prompt rise of pressure. If the animals are allowed to rest after such a series of rennin injections for two hours, the substance again provokes a rise of pressure. A curious phenomenon was noted when an animal was first injected with the juice of other organs and then

given rennin. No rise in pressure occurred. Cutting off the nerve control of the vascular system did not check the action of rennin. In conclusion the authors say that the action of rennin, like that of adrenalin, is exerted on the muscles of the peripheral vessels. They further suggest the possible significance of rennin in connection with the high arterial tension of kidney disease, especially with the sclerotic type of kidney.

A few months before the publication of the above paper the work of PEARCE (*Jour. Exper. Med.*, 1909, xi, 430) upon a similar problem appeared. He found, rather in contradiction to Bingel and Strauss, that injections of extracts of rabbits' kidneys caused in rabbits a very slight rise in blood pressure; extracts of dogs' kidneys caused in dogs a marked fall in pressure; while extracts of cats' kidneys produced in cats a decided rise. Thus, each animal reacted differently to injections of extracts of kidneys of the same species. It was found, besides, that each animal always reacted in the same way toward kidney extracts of other species. Thus, dog's kidney extracts caused a slight rise of pressure in rabbits, while rabbit's kidney extracts produced a marked fall of pressure when injected into dogs. The extracts of kidneys which are the seat of experimental nephritis do not differ from those of normal kidneys. The serum, however, from dogs and rabbits which are the subjects of experimental uranium and chromate nephritis contains substances which cause some disturbance in blood pressure, evidenced either by a rise or fall when injected into other animals.

The Influence of Coronary Disease on the Heart Muscle, with Especial Reference to Chronic Aortitis.—There has always been discussion as to whether the coronaries were true end-arteries or whether they anastomosed. Even after Lanzer's work in 1880 arguments were still advanced to uphold Cohnheim's view that the coronaries are end-arteries. Very closely dependent upon this anatomical point is the relation of coronary disease to the condition of the heart muscle, and VON REDWITZ (*Virchow's Archiv*, 1909, cxcvii, Heft 3) reports a series of 18 carefully studied cases to show that heart muscle changes are rarely dependent upon disease of the coronary arteries. As an introduction, von Redwitz describes at length the vessels under discussion from an anatomical standpoint, and presents very satisfactory proof by means of ligature and injection experiments that there is a free anastomosis between the right and left coronary system and the vasa vasorum of the aortic bulb. Following this the work of Kolster is quoted to show that sudden blocking of a small branch caused, first, coagulation necrosis of heart muscle cells, and later a typical scar formation in the area supplied by the plugged branch. The resultant condition is infarction, but has been erroneously called myocarditis and grouped with that condition. The 18 cases could be divided, anatomically speaking, into two groups. In one the arterial disease was almost entirely or entirely confined to the bulb of the aorta, and affected the coronaries only by narrowing or closing their ostea. In the other group of cases the coronary arteries themselves were the seat of sclerotic changes of various degree and extent. Sections taken from different parts of the heart muscle almost always revealed numerous scar-like masses composed of fibrous tissue, small, round cells, and often larger epithelial

cells. Frequently fatty degeneration involving more or less of the organ was met with. But in only three cases could von Redwitz note any definite relation between the diseased coronaries and the distribution of the scars. For example, in one case in which both coronaries were equally diseased there were muscle changes in the region of the left apex only; in another, one coronary was completely blocked and the scars in the musculature were found distributed through the whole heart; in still others with advanced coronary disease there were no muscle changes. But it is interesting to note that in this last group a widely dilated epicardial capillary network continuous over the base of the aorta bespoke the activity of the auxiliary collateral circulation. The scars in the three cases, which were evidently due to closure of a small branch, von Redwitz believes to have been caused in the manner described by Kolster. To explain the pathogenesis of the myocardial changes in the absence of sufficient cause by coronary disease von Redwitz advances the following argument: A review of the other pathological conditions present in his 18 cases shows that 9 had marked valvular disease, 2 had aneurysm, 3 nephritis, and the remaining 4 advanced general arterial sclerosis. In other words, the myocardial changes were found in hearts which during life had been subjected to an undue amount of work, or had been injured by rheumatism.

Protozoa in the Blood in Typhus Fever.—KROMPECHER, GOLDZIEHER, and ARGYAN (*Zent. f. Bakt.*, 1909, l, 619) had an opportunity during an epidemic of typhus fever in Budapest to study 48 cases during life. In the blood of all of these patients structures which simulated parasites were found. These bodies were present both inside the red blood corpuscles and free in the plasma. They were very scarce and could only be demonstrated by the Giemsa stain. Three types of structure are described, but in general these types were similar and consisted of a pale blue ground work containing red chromatin bodies. Although they were found in very small numbers, they could be seen constantly in daily examinations of the blood of patients during the illness. In the fatal cases at autopsy these same structures were seen in smears from the bone marrow and spleen, but in no other situation. They could not be demonstrated in sections. They resembled in form more closely piroplasma than malarial parasites. The authors believe that they can exclude the possibility of these bodies being artefacts from a precipitate or stain, blood platelets, nuclear products, or the metachromatic substances of red cells, and consider them parasites connected in some way with the disease.

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